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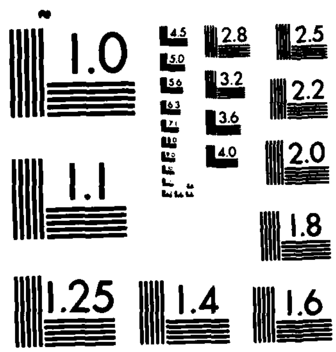

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ENGINEER WORKLOAD FACTORS

(FASTALS CONSTRUCTION MODEL)

Prepared by
Engineer Studies Center
US Army Corps of Engineers

November 1985

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. A162599	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Engineer Workload Factors (Fastals Construction Model)		5. TYPE OF REPORT & PERIOD COVERED Final USAESC-R-85-8
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Mr. Bruce W. Springfield, Mr. Robert Bockting, Mr. Eugene Ehrlich		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Engineer Studies Center, Casey Building 2594, Fort Belvoir, VA 22060-5583		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Commandant, US Army Engineer School, Fort Belvoir, VA 22060		12. REPORT DATE November 1985
		13. NUMBER OF PAGES 168
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Commandant, US Army Engineer School, Fort Belvoir, VA 22060		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE NA

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

NA

18. SUPPLEMENTARY NOTES

NA

(, back

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Construction (Wartime), Planning Factors,
Damage Repair, Force Structure,
Maintenance, Engineer,
Contingency Planning, Data Base.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study analyzed the engineer workload factors used in the Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS) Construction Model, which calculates the engineer requirements needed to accomplish 23 engineer tasks in support of contingency operations in Europe, Southwest Asia, and Northwest Asia. The study evaluated the engineer manhour effort required to accomplish a unit portion of each of the 23 tasks in each of the three theaters. Based on that evaluation, changes or adjustments to the model's workload factors

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were recommended for each of the model's 23 tasks. All the work estimates that were used to support changes or adjustments to the model's workload factors are fully documented so they can be reviewed and revised, as necessary. Keywords:

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December 1985

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Total	70

ACKNOWLEDGMENTS

The Engineer Studies Center (ESC), US Army Corps of Engineers (USACE), prepared this report under the sponsorship of the Commandant, US Army Engineer School, Fort Belvoir, Virginia. It was prepared under the overall supervision of Mr. Bruce W. Springfield (Senior Project Director) and authored by Mr. Robert Bockting and Mr. Eugene Ehrlich.

This report was prepared for publication by Miss Donna L. Jones and Ms. Stacia L. Hall, under the supervision of Mrs. Anne P. Clark. It was edited by Ms. Mary L. Scala.

Thanks are extended to LTC Cowan from the Concepts Analysis Agency; LTC Brown from the Assistant Chief of Engineers Office, and Major Capka from the Army Engineer School for their assistance and guidance throughout the study.

CONTENTS

ENGINEER WORKLOAD FACTORS

(FASTALS Construction Model)

1. Purpose. This report describes the results of an evaluation of the engineer workload factors used in of the Force Analysis Simulation of the Theater Administrative and Logical Support (FASTALS) Construction Model.

2. Background.

a. There are 23 engineer tasks and associated workload factors used in the current FASTALS Construction Model. That model estimates the engineer requirements in three theaters of operation around the world: Europe, Southwest Asia (SWA), and Northeast Asia (NEA). Because of climate and terrain differences among these areas, the model uses separate workload factors for each theater.

b. In December 1984, the US Army Engineer School (USAES) asked the Engineer Studies Center (ESC) to review each of the model's factors to ensure that they reflected the most austere standard of construction consistent with the theaters' construction policies. Where adjustments or changes were needed, ESC was to assign new factors and document how they were developed. ESC also was asked to update all factors which were associated with the use of facilities and installations from the Army Facilities Components System (AFCS) to reflect the most current construction estimates and identifying codes.

c. This study report represents ESC's response to that study request.

3. Organization. This report is organized into a series of tabs, titled according to the task numbers for which the workload factors used in the FASTALS Construction Model were derived. These tabs document, for each workload factor, the standards of construction used to evaluate the existing

factors and the method of computing new or adjusted factors for each theater. The final tab contains the sponsor's comments on the draft version of this report, and describes how ESC responded to those comments.

4. Summary of Findings.

a. Figures 1, 2, and 3 summarize all the revised engineer workload factors for the European, SWA, and NEA theaters of operation. For each workload factor, the manhour requirements are divided into two categories: that portion of the task which requires skilled labor and that portion which can be done with unskilled labor. The values for the factors now used by the FASTALS model and those new or adjusted values which are being recommended by ESC are listed in separate columns and are totaled separately. ESC divided the model's factors into labor categories to make them easier to adjust in the event unskilled labor can be supplied by the host nation (HN).

b. ESC's evaluation recommends adjustments or changes to almost every factor now used by the FASTALS model to calculate engineer workload. Specifically, for the European theater, this analysis determined that seven of the FASTALS factors should be adjusted to reflect an increased engineer effort to accomplish the stated task, eleven should be decreased, three should be given minor (almost negligible) adjustments, one should be eliminated as an engineer work requirement, and one should be restructured to allow a basic change in the way it is calculated. Similar trends were followed by the SWA and NEA theaters.

5. Discussion of Findings. The many changes ESC is proposing be made to the engineer workload factors currently used by the FASTALS Construction Model are explained, in detail and by FASTALS task, in Tabs A through W.

SUMMARY OF ENGINEER WORKLOAD FACTORS--EUROPE

No.	Task Description	Unit of Measure	Effort: Old* Skilled	Old* Unskilled	Old* Total	New Skilled	New Unskilled	New Total
				DAMAGE REPAIR**				
1	Roads	Manhours/Mile of Road	6,195	--	--	1,830	542	2,372
2	Highway Bridges	Manhours/Mile of Road	91	--	--	206	169	375
3	Railroads	Manhours/Mile of Railroad	1,840	--	--	1,818	4,752	6,570
4	Railroad Bridges	Manhours/Mile of Railroad	1,436	--	--	1,077	648	1,725
5	Pipelines	Manhours/Mile of Pipe	374	--	--	830	1,084	1,914
6	Ports	Manhours/Ton of Cargo	58.8	--	--	8.4	2.5	10.9
7	Army Airfields	Manhours/Airfield	1.84	--	--	1,305	483	1,788
				CONSTRUCTION				
8	Troop Camps	Manhours/Man	25.5	--	--	5.8	3.0	8.8
9	Administrative Space	Manhours/Man in COMMZ	3.98	--	--	2.9	0.6	3.5
10	General Supply Storage	Manhours/Ton	0.093	--	--	2.6	0.9	3.5
11	Ammunition Storage	Manhours/Ton	0.81	--	--	5.2	1.9	7.1
12	Refrigerated Storage	Manhours/Ton	3.3	--	--	3.2	2.4	5.6
13	POL Storage	Manhours/Ton	1.1	--	--	0.7	0.4	1.1
14	PW Camps	Manhours/PW	7.9	--	--	22	13	35
15	Military Stockade	Manhours/Man in Theater	0.543	--	--	0.06	0.04	0.10
16	Hospitals	Manhours/Bed	40.4	--	--	--	--	--
	Renovations w/o DMS	Manhours/Bed	--	--	--	20.4	1.8	22.2
	Renovations w/DMS	Manhours/Bed	--	--	--	8.0	0.6	8.6
	Field w/o DMS	Manhours/Bed	--	--	--	100.2	14.2	114.4
	Field w/DMS	Manhours/Bed	--	--	--	52.2	9.2	61.4
17	Dispensaries, Dental Clinics, and Labs	Manhours/Man in COMMZ	0.919	--	--	0.97	--	0.97
18	Maintenance Facility	Manhours/Man in COMMZ	1.1	--	--	1.4	0.4	1.8
19	Replacement Camps	Manhours/Replacement	85.9	--	--	6.9	4.3	11.2
				MAINTENANCE				
20	Roads	Manhours/Mile/Day	1.20	--	--	1.74	2.03	3.77
21	Railroads	Manhours/Mile/Day	1.84	--	--	1.82	4.75	6.57
22	Pipelines	Manhours/Mile/Day	3.74	--	--		Eliminated	
23	Ports	Manhours/Ton/Day	0.019	--	--	0.009	0.002	0.011

*Department of the Army, Office of the Chief of Staff, Army, Concepts Analysis Agency, Management and Support Directorate, Army Force Planning Data and Assumptions, FY 1985-1994 (AFPDA FY 85-94) (U), Bethesda, Maryland, November 1984 (SECRET-RESTRICTED DATA-NOFORN-WNINTEL-NOCONTRACT/CONSULTANT) (hereafter referred to as AFPDA 85-94).

**Workload factors for damage repair are applied only to the damaged portion of the asset being utilized.

Figure 1

SUMMARY OF ENGINEER WORKLOAD FACTORS--SWA

Task No.	Task Description	Unit of Measure	Effort: Old* Skilled	Old* Unskilled	Old* Total	New Skilled	New Unskilled	New Total
	DAMAGE REPAIR**							
1	Roads	Manhours/Mile of Road	--	--	8,850	4,997	1,642	6,639
2	Highway Bridges	Manhours/Mile of Road	--	--	372	269	231	500
3	Railroads	Manhours/Mile of Railroad	--	--	7,556	2,548	6,669	9,211
4	Railroad Bridges	Manhours/Mile of Railroad	--	--	3,553	1,652	994	2,646
5	Pipelines	Manhours/Mile of Pipe	--	--	717	824	1,253	2,077
6	Ports	Manhours/Ton of Cargo	--	--	81.5	12.8	3.8	16.6
7	Army Airfields	Manhours/Airfield	--	--	9.62	1,501	556	2,057
	CONSTRUCTION							
8	Troop Camps	Manhours/Man	--	--	31.1	12.0	5.1	17.1
9	Administrative Space	Manhours/Man in COMMZ	--	--	4.9	3.7	0.8	4.5
10	General Supply Storage	Manhours/Ton	--	--	0.158	3.4	1.2	4.6
11	Ammunition Storage	Manhours/Ton	--	--	1.1	17.1	6.6	23.7
12	Refrigerated Storage	Manhours/Ton	--	--	6.66	3.7	2.7	6.4
13	POL Storage	Manhours/Ton	--	--	1.86	0.8	0.5	1.3
14	PW Camps	Manhours/PW	--	--	12.9	33	17	50
15	Military Stockade	Manhours/Man in Theater	--	--	0.99	0.06	0.04	0.10
16	Hospitals	Manhours/Bed	--	--	47.5	--	--	--
	Renovations w/o MIS	Manhours/Bed	--	--	--	23.5	2.0	25.5
	Renovations w/MIS	Manhours/Bed	--	--	--	9.0	0.9	9.9
	Field w/o MIS	Manhours/Bed	--	--	--	114.5	16.4	130.9
	Field w/MIS	Manhours/Bed	--	--	--	54.5	9.8	64.3
17	Dispensaries, Dental Clinics, and Labs	Manhours/Man in COMMZ	--	--	0.978	1.61	0.12	1.73
18	Maintenance Facility	Manhours/Man in COMMZ	--	--	1.41	1.6	0.4	2.0
19	Replacement Camps	Manhours/Replacement	--	--	108.8	11.1	6.3	17.4
	MAINTENANCE							
20	Roads	Manhours/Mile/Day	--	--	3.22	1.78	2.18	3.77
21	Railroads	Manhours/Mile/Day	--	--	7.56	2.7	6.7	9.2
22	Pipelines	Manhours/Mile/Day	--	--	7.17		Eliminated	
23	Ports	Manhours/Ton/Day	--	--	0.027	0.013	0.004	0.017

*AFPDA 85-94.
**Workload factors for damage repair are applied only to the damaged portion of the asset being utilized.

Figure 2

SUMMARY OF ENGINEER WORKLOAD FACTORS--NEA

No.	Task Description	Unit of Measure	Effort Old* Skilled	Effort Old* Unskilled	Effort Old* Total	Effort New Skilled	Effort New Unskilled	Effort New Total
	DAMAGE REPAIR**							
1	Roads	Manhours/Mile of Road	--	--	8,850	4,345	1,428	5,773
2	Highway Bridges	Manhours/Mile of Road	--	--	431	261	232	493
3	Railroads	Manhours/Mile of Railroad	--	--	8,570	2,192	5,732	7,924
4	Railroad Bridges	Manhours/Mile of Railroad	--	--	6,179	2,872	1,728	4,600
5	Pipelines	Manhours/Mile of Pipe	--	--	623	528	999	1,527
6	Ports	Manhours/Ton of Cargo	--	--	70.9	9.4	2.8	12.2
7	Army Airfields	Manhours/Airfield	--	--	8.36	1,305	483	1,788
	CONSTRUCTION							
8	Troop Camps	Manhours/Man	--	--	31.1	10.4	4.5	14.9
9	Administrative Space	Manhours/Man in COMZ	--	--	4.9	3.3	0.7	4.0
10	General Supply Storage	Manhours/Ton	--	--	0.158	3.0	1.0	4.0
11	Ammunition Storage	Manhours/Ton	--	--	1.1	14.8	5.7	20.6
12	Refrigerated Storage	Manhours/Ton	--	--	5.79	3.2	2.4	5.6
13	POL Storage	Manhours/Ton	--	--	1.62	0.7	0.4	1.1
14	PW Camps	Manhours/PW	--	--	12.9	28	16	44
15	Military Stockade	Manhours/Man in Theater	--	--	0.862	0.07	0.05	0.12
16	Hospitals	Manhours/Bed	--	--	47.5	--	--	--
	Renovations w/o DIS	Manhours/Bed	--	--	--	20.4	1.8	22.2
	Renovations w/DIS	Manhours/Bed	--	--	--	8.0	0.6	8.6
	Field w/o DIS	Manhours/Bed	--	--	--	100.2	14.2	114.4
	Field w/DIS	Manhours/Bed	--	--	--	52.2	9.2	61.4
17	Dispensaries, Dental Clinics, and Labs	Manhours/Man in COMZ	--	--	0.978	0.97	--	0.97
18	Maintenance Facility	Manhours/Man in COMZ	--	--	1.41	1.4	0.4	1.8
19	Replacement Camps	Manhours/Replacement	--	--	108.8	9.7	5.4	15.1
	MAINTENANCE							
20	Roads	Manhours/Mile/Day	--	--	2.8	1.74	2.03	3.77
21	Railroads	Manhours/Mile/Day	--	--	6.57	2.2	5.7	7.9
22	Pipelines	Manhours/Mile/Day	--	--	6.23		Eliminated	
23	Ports	Manhours/Ton/Day	--	--	0.024	0.009	0.003	0.012

*AFPDA 85-94.
**Workload factors for damage repair are applied only to the damaged portion of the asset being utilized.

Figure 3

a. In general, three reasons influenced ESC's decision to change the existing engineer workload factors: changes in guidance concerning the standards and type of construction to be performed in the RCZ/COMMZ; significant changes to the AFCS, which is the primary estimating tool for engineer workload calculation; and the realization that some of the old factors were picked to both quantify the work tasks, and to scope the calculated requirements to conform to predetermined limits.

(1) Current policy establishes standards of engineer work in the RCZ/COMMZ to be performed at the minimum, most austere interpretation of the "initial" standard. This policy--and the workload factors which are based on it--apply to war damage repair, construction, and maintenance activities. ESC screened each FASTALS task, and each facility or installation work estimate that comprised the task being evaluated, to eliminate any non-essential element.

(2) The AFCS is continually being reviewed and revised by both peacetime and wartime users of the system. There have been some rather significant changes and additions to the system in recent years. The general trend has been to lower the standards of construction and to add more combat engineering and war damage repair tasks. The AFCS continues to lack estimates for the conversion and alteration of existing civilian structures to wartime military use--this is a major shortfall of the system. For ESC's workload analysis, medical tasks incorporated into the FASTALS model (Tasks 16 and 17) were based on an engineer estimate which considered that existing HN facilities would be converted to military use. The workload factors for the other engineer tasks used the most current AFCS data available.

(3) There are some indications that the model's current workload factors have been modified over time to limit the engineer requirements computed. In many cases, portions or essential elements of an engineer task had been eliminated from the workload estimate, thus unrealistically reducing the engineer requirements. For example, the workload factors for the general supply storage task only calculate workload associated with providing a single type of storage facility (open storage); in the the maintenance, parking, and ice plant task only one factor is used, instead of a sum of three individual factors. To correct such problems, ESC reviewed each task critically and eliminated those projects no longer required because of changes in operational concepts or the fielding of new equipment items.

6. Theater of Operation Planning Considerations. The planning considerations used to calculate the workload estimates for each of the three theaters (Europe, SWA, and NEA) are listed in Figure 4. The climatic and terrain conditions relate directly to the facility selection criteria given by the AFCS. In general, desert climatic conditions increase personnel effort by about 15 percent over temperate zone conditions. Mountainous terrain also significantly increases the horizontal effort required to accomplish any given engineer task.

THEATER PLANNING CONSIDERATIONS

	Theater		
Consideration	Europe	SWA	NEA
Climate/Zone	Temperate	Desert	Temperate
Terrain	Rolling	Mountainous	Mountainous
Vegetation	Woodland	Grass/None	Grass/None
Rock	Moderate	Moderate	Moderate

Figure 4

7. Analysis of War Damage Repair Workload Factors.

a. War damage repair workload factors must be examined with an understanding about how the quantity of damage is calculated and how the workload factors are applied to estimate engineer force requirements. Construction model Tasks 1 through 7 deal with the damage repair of lines of communication (LOC)-type facilities. The number of facilities that are damaged and therefore require repair are calculated by multiplying the quantity of LOC assets that must be in use to move the required through-put of supplies times an estimated damage factor. This damage factor represents that percentage of the LOC-type facility that is expected to be damaged by enemy air, ground, sea, or sabotage activity. The resultant damage is generally expressed as miles of facility damaged (i.e., roads or railroad) and is really just a small subset of the entire LOC being utilized. Therefore, the engineer workload factor is applied only to that damaged segment of the facility. For example, 3,000 miles of roads may be required in the LOC system to move a certain tonnage of supplies and equipment during a given time period. If the damage factor assigned by the FASTALS model to roads during that period is 2 percent, then 60 miles of road could be assumed damaged (3,000 x 0.02 = 60). The total engineer effort during that time period to repair roads (whether done by US Army engineers or the HN) would be the engineer workload factor times the damaged road: 2,372 manhours/mile x 60 miles = 142,320 manhours.

b. ESC is recommending several significant changes to the engineer workload factors for damage repair:

(1) Task 1 (Tab A--Roads). The new workload factor is based on a combination of damage projects that one would expect to encounter on a modern battlefield. These are crater repair, rubble removal, and the construction of some new road segments to bypass sections of unrepairable damage. The

old factor was based entirely on the new construction of roads. The new factor for the European theater is approximately one-third the value of the old factor. The nature of the repair tasks (and therefore the workload factors) were also modified for the SWA and NEA theaters.

(2) Task 5 (Tab E--Pipelines). The AFCS has developed a facility estimate for the repair or replacement of a 200-foot damaged segment of pipeline. The new FASTALs factor being recommended by ESC used this concept of repairing a series of short segments and pumping stations to represent expected wartime damage. The old factor now used by the model assumes that a 1-mile long section of pipe would be built. The old factor is about one-third the value of the new factor.

(3) Task 6 (Tab F--Ports). Based on guidance received from the Study Advisory Group (SAG), ESC calculated a workload estimate for Task 6 that limited the repair of ports to repairing piers and wharfs. The old factor was based on a more comprehensive array of tasks, including access and egress routes and storage facilities. The new factor is about 15 percent of the old one.

(4) Task 7 (Tab G--Army Airfields). ESC's new factor for the damage repair of Army airfields is based on a completely new method of estimating requirements. The number of Army airfields required in the RCZ/COMMZ will be input to the model by the player and will be based on either guidance from the theater or an allocation rule (e.g., one airfield per corps). The new engineer workload factor provides the engineer effort required to repair a support area Army airfield if it were 100 percent damaged. When the workload factor is multiplied by the damage factor, the result is the engineer effort required to repair that expected level of damage.

8. <u>Analysis of Construction Workload Factors</u>. Twelve engineer tasks are listed in the construction section of the FASTALS Construction Model. The tasks supply the facilities needed in the RCZ/COMMZ to receive and process the men and materiel required to support the theater conflict. When existing assets are input to the model, they are used to offset wartime requirements. For all the construction tasks, the type of facility provided is dictated by the construction standard. That, in turn, determines the magnitude of the engineer workload factor. ESC made every effort to identify the most austere facility consistent with the mission associated with the task, and to provide the most efficient facility size from the consideration of the construction effort. The AFCS is the only system of predesigned facilities and installations that provide the needed estimates of engineer manhour requirements for the construction of facilities at various standards, ranging from tent camps with unsurfaced roads to permanent camps with wood structures, utility systems, and paved roads. ESC used the initial or most austere standard of construction defined in the AFCS to develop the manpower estimates applied to derive the workload factors. Each facility or installation drawn from the AFCS system was reviewed carefully and items believed to be in excess of the absolute requirements were eliminated. The workload factors for medical facilities, which include hospitals, medical clinics, and laboratories, were developed primarily by estimating the engineer effort required to renovate and adapt existing HN structures. (This was a departure from using the AFCS; it is discussed in more detail in Tabs P and Q.) These same engineer workload factors are used to determine the engineer requirements for repairing war damage to the RCZ/COMMZ support facilities. ESC is recommending major changes to the workload factors for the following construction tasks:

a. Task 8 (Tab H--Troop Camps). The workload factor for troop camps has been drastically reduced. The initial, austere standard of construction calls only for unsurfaced tent pads, gravel-surfaced internal roads and hardstands, and cesspool sanitation facilities. The occupying unit will erect all the tents and provide all security fencing, guard emplacements, and internal services such as utilities and communication.

b. Task 10 (Tab J--General Supply Storage). The workload factor now use by the FASTALS Construction Model only provides for open storage facilities. However, ESC is recommending a workload factor that provides the proper proportion of both covered and open storage facilities, plus the minimum standard of gravel-surfaced roads and hardstands, site preparation, and the fire sumps required for a wartime supply installation. The result of adding the necessary covered storage facilities is a significant increase in the workload factor.

c. Task 11 (Tab K--Ammunition Storage). The new workload factor for ammunition facilities considers only the work necessary to provide unsurfaced hardstands and roads. There are no covered storage facilities, fencing, or security structures provided. This is a marginal facility that will experience difficulty supporting containerized Class V operations.

d. Task 14 (Tab N--PW Camps). The workload factor for this type of installation is considerably higher than the one developed for troop housing despite the fact that they are for the same standard of construction. In comparing the two factors, it must be remembered that the austere standard for these facilities is so sparse that adding simple things such as wire fences and lighting (which are required in a PW camp) dramatically increases the engineer requirement. PW labor could be used to meet the unskilled labor

portion of this requirement, thereby reducing by about one-third the value of the workload factor.

e. Task 16 (Tab P--Hospitals). The workload factor for this task in the European and NEA theaters is based on the availability and use of HN facilities and utilities for a major portion of the hospital requirements. Very limited cleaning and renovation or alteration work was considered in the calculations of the labor needed to transform a general facility into a hospital. ESC made estimates both with and without considering the use of Deployable Medical Systems (DMS) for the core hospital requirements. For the SWA theater, host nation facilities and utilities were not assumed to be available; therefore, the workload factor is based on the minimum standard AFCS facility. It is assumed that a hospital can be initially deployed and set up using DMS and tent facilities; the engineers would begin building the AFCS facilities as soon as construction assets permit, since providing medical care exclusively from a field facility would soon degrade capability and lower the quality of care below levels expected of an RCZ/COMMZ hospital.

f. Task 19 (Tab S--Replacement Camps). ESC is recommending that this workload factor be reduced by over 90 percent. The new factor considers the engineer work needed to provide a tent camp with minimum messing and processing capabilities. The concept for replacement camps provides for an average stay of 2 days.

9. Analysis of Maintenance Workload Factors. The engineer workload associated with maintenance is limited to LOC infrastructure assets (roads, railroads, pipelines, and ports) within the RCZ/COMMZ that are being used to support US logistics operations. Assets that are excess to the needs of the logistics system are not maintained. Within the FASTALS Construction Model,

the calculation of maintenance requirements is limited to large LOC tasks that are normal missions of the engineer combat heavy battalions. Maintenance support to installations normally is provided by facility engineer units whose requirements are determined by other means. The standards of maintenance performed is that minimum work required to keep the facility in a usable condition. ESC is recommending two significant changes to the maintenance workload factors:

a. Task 22 (Tab V--Pipelines). The maintenance of pipelines is the responsibility of the operating organization and is not an engineer requirement. At the request of the SAG, ESC eliminated the engineer workload factor for this task.

b. Task 23 (Tab W--Ports). Like the damage repair task for ports, the maintenance task is limited to the pier and wharf areas. As a result, the new workload factor is less than half of the old factor.

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TAB A

TASK 1: DAMAGE REPAIR TO ROADS

TAB A

TASK 1: DAMAGE REPAIR TO ROADS

Engineer Workload Factor Summary:

a. Europe.

Total Task:	2,372 Manhours/Mile Restored
Skilled Engineer Effort:	1,830 Manhours/Mile Restored
Unskilled Effort:	542 Manhours/Mile Restored

b. SWA.

Total Task:	6,639 Manhours/Mile Restored
Skilled Engineer Effort:	4,997 Manhours/Mile Restored
Unskilled Effort:	1,642 Manhours/Mile Restored

c. NEA.

Total Task:	5,773 Manhours/Mile Restored
Skilled Engineer Effort:	4,345 Manhours/Mile Restored
Unskilled Effort:	1,428 Manhours/Mile Restored

1. Standard of Construction: This standard is the most austere level applicable to restoration of traffic-carrying capacity required for main supply routes (MSRs) in the COMMZ. It provides a two-lane loose surface restoration of the damaged section.

2. Method For Europe: Manhour and equipment-hour requirements are developed by use of a combination of two facilities from the AFCS and two tasks described in the Engineer Family of Systems Study (E-FOSS).[1,2] The factor developed provides damage repair to 1 mile of road (or its equivalent in a series of shorter lengths) damaged over its entire length. Components making up the factor are as follows:

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[1]Department of the Army, US Army Corps of Engineers, Office of the Chief of Engineers, Huntsville Division, TM 5-301, Army Facilities Components System, Huntsville, Alabama, 17 January 1985 (UNCLASSIFIED) (hereafter referred to as TM 5-301).

[2]Department of the Army, US Army Training and Doctrine Command, US Army Engineer School, Combat Developments, Engineer Family of Systems Study (E-FOSS), Volume VII, Appendix N--Engineer Systems Data Base, Fort Belvoir, Virginia, February 1979 (UNCLASSIFIED) (hereafter referred to as E-FOSS).

a. One-half mile rebuilding equivalent (two-lane graded and drained) in rolling, wooded terrain with moderate rock. This would provide for bypass construction when repair of the existing road base is not possible.

b. Three-tenths mile of continuous craters (total of 33).

c. Two-tenths mile of rubble cleared, two lanes wide.

d. One mile of loose surface (6-inch aggregate), two lanes wide.

3. Computation: Figure A-1 shows the manhour requirements associated with road repair.

ROAD DAMAGE REPAIR--1 MILE (EUROPE)

	Manhours			
	Horizontal	Vertical	General	Total
2-Lane Class B Road (1/2 Mile)[a]	1,133	--	452	1,585
0.3 Mile of Craters (33)[b]	423	--	--	423
0.2 Mile of Rubble Cleared[c]	22	11	22	55
1.0 Mile of 6-Inch Aggregate[d]	241	--	68	309
Total	1,819	11	542	2,372

[a]Facility No. 85130 FD, (Temperate Zone), two-lane, Class B, 0.5 miles.
[b]Techniques 1 and 2, E-FOSS Tasks No. 10 and 11 (12.82 manhours/crater).
[c]E-FOSS Tasks No. 9 through 50; clear two lanes wide.
[d]Facility No. 85110 BN (Temperate Zone) provides 6-inch aggregate surface.

Figure A-1

4. Method Modifications for SWA: Manhour and equipment-hour requirements are developed by use of a combination of two facilities from the AFCS as indicated above for Europe, and one task described in the E-FOSS. The result differs from the European factor in that for SWA, the 0.2-mile segment of rubble clearing is dropped and an additional 0.2-mile segment of crater repair is substituted. This modification is made because in the SWA area the clearing

of rubble is expected to be minimal. In SWA, desert zone facilities from the AFCS are substituted for the temperate zone facilities used in Europe. The E-FOSS factor is multiplied by 1.15 to convert the effort to desert conditions. Components of the factor are as follows:

a. One-half mile rebuilding equivalent (two lanes, graded and drained, constructed in mountainous conditions with little or no vegetation and moderate rock).

b. One-half mile of continuous craters (total of 53) are filled and compacted.

c. One-mile of loose surface (6-inch aggregate), two lanes wide.

5. Computation: Figure A-2 shows the manhour requirements for road repair.

ROAD DAMAGE REPAIR--1 MILE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
2-Lane Class B Road (0.5 Mile)[a]	3,939	--	1,564	5,503
0.5 Mile of Craters (53)[b]	781	--	--	781
1.0 Mile of 6-Inch Aggregate[c]	277	--	78	355
Total	4,997	--	1,642	6,639

[a]Facility No. 85130 FW (Desert Zone) two lane, Class B, 0.5 miles.
[b]Techniques 1 and 2, E-FOSS Tasks No. 10 and 11 (14.73 manhours/crater, desert conditions).
[c]Facility No. 85110 BN (Desert Zone) provides 6-inch aggregate surface.

Figure A-2

6. Method Modifications for NEA: Manhour and equipment-hour requirements are developed similarly to those for SWA in that no factor is included for rubble clearance. However, temperate zone facilities are used in NEA. Components of the factor are as follows:

a. One-half mile rebuilding equivalent (two lanes, graded and drained, constructed in mountainous conditions with little or no vegetation and moderate rock).

b. One-half mile continuous craters (total of 53).

c. One mile loose surface (6-inch aggregate), two lanes wide.

7. Computation: Figure A-3 shows the manhours required for road repair.

ROAD DAMAGE REPAIR--1 MILE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
2-Lane Class B Road (0.5 Mile)[a]	3,425	--	1,360	4,785
0.5-Mile Craters (53)[b]	679	--	--	679
1.0-Mile 6-Inch Aggregate[c]	241	--	68	309
Total	4,345	--	1,428	5,773

[a]Facility No. 85130 FW (Temperate Zone), two lane, Class B, 1/2 mile.
[b]Techniques 1 and 2 (E-FOSS Task No. 10 and 11) (12.82 manhours/crater).
[c]Facility No. 85110 BN (Temperate Zone) provides 6-inch aggregate surface.

Figure A-3

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TAB B

TASK 2: DAMAGE REPAIR TO HIGHWAY BRIDGES

TAB B

TASK 2: DAMAGE REPAIR TO HIGHWAY BRIDGES

Engineer Workload Factors:

a. Europe:

Total Task:	375 Manhours (bridge gap 40 feet/mile road)[1]
Skilled Engineer Effort:	206 Manhours
Unskilled Effort:	169 Manhours

b. SWA:

Total Task:	500 Manhours (bridge gap 60 feet/mile road)[1]
Skilled Engineer Effort:	269 Manhours
Unskilled Effort:	231 Manhours

c. NEA:

Total Task:	493 Manhours (bridge gap 80 feet/mile road)[1]
Skilled Engineer Effort:	261 Manhours
Unskilled Effort:	232 Manhours

1. Standard of Construction: The standard of construction adopted is the most austere level compatible with restoration of two-way traffic across damaged bridging on the COMMZ MSRs.

2. Method for Europe: Manhour requirements are derived by use of facilities from the AFCS. Those facilities selected are as follows: Facility No. 85120 HE provides a complete set of Bailey bridging. For planning purposes, one-half set is selected to provide for 40 feet of double-lane bridge. In addition, Facility No. 85120 EC is employed to provide a replacement pier.

3. Computation: Figure B-1 shows the manhours required to restore the bridging associated with 1 mile of damaged road, where the bridge gap is 40 feet.

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[1]Department of the Army, US Army Corps of Engineers, Engineer Studies Center, Force Planning Activities, Washington, D. C., January 1970 (SECRET) (hereafter referred to as Force Planning Activities).

HIGHWAY BRIDGE REPAIR (EUROPE)

	Manhours			
	Horizontal	Vertical	General	Total
40-foot Bailey (2-Lane)*	55	--	64	119
One Timber Pile Pier**	50	101	105	256
Total	105	101	169	375

*AFCS Facility No. 85120 HE (1/2 set) (Temperate Zone)
**AFCS Facility No. 85120 EC (Temperate Zone)

Figure B-1

4. Method Modifications for SWA: Manhour requirements are derived (as for Europe above) by use of facilities from the AFCS. For SWA, facilities for Desert Zone are utilized. Since the highway bridge gap in the SWA area is 60 feet per mile of road, three-quarters of a bridge set is provided for each mile of road on which bridging is damaged. A single pier is provided per mile as in the European factor above.

5. Computation: Figure B-2 shows the manhour requirements to restore bridging on 1 mile of damaged road in which the bridge gap is 60 feet per mile.

HIGHWAY BRIDGE REPAIR (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
60-foot Bailey (2-Lane)*	95	--	110	205
One Timber Pile Pier**	58	116	121	295
Total	153	116	231	500

*AFCS Facility No. 85120 HE (3/4 set) (Desert Zone)
**AFCS Facility No. 85120 EC (Desert Zone)

Figure B-2

6. <u>Method Modifications for NEA</u>: Manhour requirements are derived similarly to those for Europe in that temperate zone factors are used. However, the NEA average highway bridge gap is 80 feet per mile of road. Therefore, a full set of Bailey bridge is provided per mile. A single pier is provided for each.

7. <u>Computation</u>: Figure B-3 shows the manhours required to restore bridging.

HIGHWAY BRIDGE REPAIR (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
80-foot Bailey (2-Lane)*	110	--	127	237
One Timber Pile Pier**	50	101	105	256
Total	160	101	232	493

*AFCS Facility No. 85120 HE (one set) (Temperate Zone)
**AFCS Facility No. 85120 EC (Temperate Zone)

Figure B-3

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TAB C

TASK 3: DAMAGE REPAIR TO RAILROADS

TAB C

TASK 3: DAMAGE REPAIR TO RAILROADS

Engineer Workload Factors:

a. Europe.

Total Task:	6,570 Manhours/Mile Restored
Skilled Engineer Effort:	1,818 Manhours/Mile Restored
Unskilled Effort:	4,752 Manhours/Mile Restored

b. SWA.

Total Task:	9,211 Manhours/Mile Restored
Skilled Engineer Effort:	2,548 Manhours/Mile Restored
Unskilled Effort:	6,669 Mahhours/Mile Restored

c. NEA.

Total Task:	7,924 Manhours/Mile Restored
Skilled Engineer Effort:	2,192 Manhours/Mile
Unskilled Effort:	5,732 Manhours/Mile

1. Standard of Construction: The standard recommended is the most austere level which can be used to restore traffic-carrying capability (single-track operation) to damaged railroads.

2. Method for Europe: Manhour effort factors are derived by use of Facility No. 86010 AA (Temperate Zone) from the AFCS. This provides for the installation (replacement) of the equivalent of 1 mile of single-track railroad.

3. Computation: Figure C-1 shows the manhour requirements for this task.

RAILROAD REPAIR--1 MILE (NATO)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 86010 AA (1 Mile, Single Track)	1,818	--	4,752	6,570

Figure C-1

4. Method Modifications for SWA: Manhour effort factors are derived by use of Facility No. 86010 AA (Desert Zone) from the AFCS. This facility provides for the reconstruction of the equivalent of 1 mile of single-track railroad under desert conditions. This factor differs from the European factor only in that it multiplies the manhour requirements by 1.15 to show a modest increase due to heat and dust and other conditions relative to a desert environment. The basic factor contains no adjustment for a change from the rolling terrain prevailing in Europe to the mountainous conditions of the SWA area of operations. Information on the derivation of the make-up of the AFCS factor is unavailable.[1] However, FM 5-35[2] has a figure (page 6-16, Figure 6-8) which breaks out tasks in railroad construction. Factors for bridging and culverts in the figure are disregarded in this discussion, which is primarily concerned with relaying of ties and track, reshaping of ballast, and providing a small amount of regrading. The figure in FM 5-35 shows a factor of 3,400 manhours for laying track and ties and 2,500 manhours for ballast. Subtracting these items from the 6,570 total manhours in Facility No. 86010 AA (Temperate Climate, Europe) leaves 670 manhours, which is then taken to represent a minimum amount of regrading. In turn, it is this regrading component which requires adjustment when changing from a rolling terrain environment to a mountainous one. The size of the adjustments from European rolling to SWA mountainous (desert) and to NEA mountainous (temperate) is determined by using the proportional adjustments shown in the AFCS facilities for road construction.[3] Figure C-2 shows how that ratio is derived.

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[1]Telephone conversation between ESC staff members and Mr. Fred Steinman, AFCS Office, Huntsville Division, on 1 May 1985.

[2]Department of the Army, Headquarters, FM 5-35, Engineer Reference and Logistical Data, Washington, D. C., April 1971 (UNCLASSIFIED).

[3]Conversation with Mr. Fred Steinman, 1 May 1985.

ROAD REBUILDING AREA ADJUSTMENT

	Total Manhours	Ratio
Europe Facility No. 85130 FD[a]	3,170	1.0
SWA Facility No. 85130 FW[b]	11,005	3.47
NEA Facility No. 85130 FW[c]	9,569	3.02

[a]1 mile of road--rolling, woodland, moderate rock, temperate.
[b]1 mile of road--mountainous, grass, moderate rock, desert.
[c]1 mile of road--mountainous, grass, moderate rock, temperate.

Figure C-2

Figure C-3 shows the derivation of the regrading time factor increments for application to SWA and NEA.

REGRADING INCREMENT OF RAILROAD REPAIR

	Manhours			
	Horizontal	Vertical	General	Total
Europe (1.0)	185	--	485	670
SWA (3.47)	642	--	1,683	2,325
NEA (3.02)	559	--	1,465	2,024

Figure C-3

5. Computation. The repair factor for SWA is derived by first subtracting the basic European regrading increment from the 1-mile railroad repair facility for SWA, Facility No. 86010 AA (Desert Zone). This leaves only effort requirements for track, ties, and ballast to which is then added the SWA regading increment from Figure C-3. Figure C-4 shows the total manhour requirement developed.

RAILROAD REPAIR--1 MILE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Track, Ties, Ballast	1,906	--	4,980	6,886
Regrading	642	--	1,683	2,325
Total	2,548	--	6,669	9,211

Figure C-4

6. Method of Modification for NEA: Manhour effort factors are derived by use of AFCS Facility No. 86010 AA (Temperate Zone). This is basically the same facility as used in NATO Europe, except that the same system of modification of the regrading increment is applied as employed for SWA and described in paragraphs 4 and 5 above. The derivation of the ratio of adjustment is shown in Figure C-2 and the quantity of the increment is shown in Figure C-3.

7. Computation. The repair factor for NEA is derived by first subtracting the basic regrading increment from the 1 mile railroad repair Facility No. 86010 AA (Temperate Zone), then adding the NEA regrading increment from Figure C-3. The total manhour requirement for railroad repair is shown on Figure C-5.

RAILROAD REPAIR--1 MILE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Track, Ties, Ballast	1,633	--	4,267	5,900
Regrading	559	--	1,465	2,024
Total	2,192	--	5,732	7,924

Figure C-5

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TAB D

TASK 4: DAMAGE REPAIR TO RAILROAD BRIDGES

TAB D

TASK 4: DAMAGE REPAIR TO RAILROAD BRIDGES

Engineer Workload Factors:

a.	Europe.	
	Total Task:	1,725 Manhours/Mile Railroad Restored (Bridge Gap 60 feet)[1]
	Skilled Engineer Effort:	1,077 Manhours/Mile Railroad Restored
	Unskilled Effort:	648 Manhours/Mile Railroad Restored
b.	SWA:	
	Total Task:	2,646 Manhours/Mile Railroad Restored (Bridge Gap 80 feet)[1]
	Skilled Engineer Effort:	1,652 Manhours/Mile Railroad Restored
	Unskilled Effort:	994 Manhours/Mile Railroad Restored
c.	NEA:	
	Total Task:	4,600 Manhours/Mile Railroad Restored (Bridge Gap 160 feet)[1]
	Skilled Engineer Effort:	2,872 Manhours/Mile Railroad Restored
	Unskilled Effort:	1,728 Manhours/Mile Railroad Restored

1. Standard of Construction: The standard of construction used is the most austere level which will adequately restore a damaged railway bridge so that it will pass rail traffic safely.

2. Doctrinal Implications: Current doctrinal publications indicate that the mission of maintenance and repair to railroads is a transportation unit responsibility. The Transportation Railway Engineer Company, Table of Organization and Equipment (TOE) 55-227, in fact, has a TOE mission statement: "to maintain and repair railway tracks, bridges, buildings, and railway signals and communications within a railway division." Though none of these units are currently within the Army Force Structure, one company is scheduled for activation in FY 87. Should this unit be deployed to a specific theater of

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[1]Force Planning Activities.

operations, the workload generated by this task would not be accomplished by engineer units.

3. Method for Europe: Manhour effort factors are provided in AFCS Facility No. 86030 TP, which provides 40 feet of rail bridge. To adapt this to the planning factor for the 60-foot bridge gap in the NATO rail system, the manhour factors are multiplied by 1-1/2.

4. Computation: Figure D-1 shows the manhours of effort required to restore damaged bridging (60 feet) on a typical mile of damaged railroad.

RAILROAD BRIDGE REPAIR (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Bridge, 60-foot 1.5 x Facility No. 86030 TP	195	882	648	1,725

Figure D-1

5. Method Modifications for SWA: Manhour requirements are derived as in NATO, by use of facilities from the AFCS. In SWA, however, facilities for Desert Zone are substituted to fit construction conditions of the area. The rail bridge gap in this area is 80 feet per mile of track. This requires two 40-foot facilities--Facility No. 86030 TP Desert Zone).

6. Computation: Figure D-2 shows the manhours of effort required to restore damaged bridging (80 feet) on a typical mile of damaged railroad.

RAILROAD BRIDGE REPAIR (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Bridge, 80-foot 2 x Facility No. 86030 TP (Desert Zone)	300	1,352	994	2,646

Figure D-2

7. Method Modifications for NEA: Manhour requirements are derived here similarly to those for NATO Europe in that temperate zone factors are used. However, the NEA railroad bridge gap is 160 feet per mile. AFCS Facility No. 86030 TP provides a 40-foot bridge repair. Four such facilities are used in this repair factor.

8. Computation: Figure D-3 shows the effort required to restored damaged railroad bridging.

RAILROAD BRIDGE REPAIR (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Bridge, 160-foot 4 x Facility No. 86030 TP (Temperate Zone)	520	2,352	1,728	4,600

Figure D-3

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TAB E

TASK 5: DAMAGE REPAIR TO PIPELINES

TAB E

TASK 5: DAMAGE REPAIR TO PIPELINES

Engineer Workload Factor:

a. Europe.

Total Task:	1,914 Manhours/Mile Restored
Skilled Engineer Effort:	803 Manhours/Mile Restored
Unskilled Effort:	1,084 Manhours/Mile Restored

b. SWA.

Total Task:	2,077 Manhours/Mile Restored
Skilled Engineer Effort:	824 Manhours/Mile Restored
Unskilled Effort:	1,253 Manhours/Mile Restored

c. NEA.

Total Task:	1,527 Manhours/Mile Restored
Skilled Engineer Effort:	528 Manhours/Mile Restored
Unskilled Effort:	999 Manhours/Mile Restored

1. Standard of Construction: The standard of construction employed is the most austere level compatible with restoration of required capacity to damaged pipeline.

2. Method for Europe: Manhour requirements are developed by the use of a combination of facilities from the AFCS.

a. The 1-mile planning segment is composed of pipeline bomb damage facilities, each providing for the restoration of pipe in a 200-foot gap. The factor developed consists of 0.2 mile of 4-inch diameter pipe, 0.4 mile of 6-inch diameter pipe, and 0.4 mile of 8-inch diameter pipe. This is in accordance with relative lengths as specified in TAA-88.[1]

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[1] Department of the Army, Office of the Chief of Staff, Army, Concepts Analysis Agency, Forces Directorate, Total Army Analysis FY 84-88 (TAA-88) (U), Bethesda, Maryland, January 1983 (SECRET) (hereafter referred to as TAA-88).

b. In addition, the 1-mile segment is assumed to contain a fraction (0.06) of a pumping station. This represents about one pump station for an average of 17 miles of pipeline.

c. A further adjustment to this factor is required since only about 11 percent of the total pipeline to which damage may occur is the bolted, low-pressure type. The remainder--some 89 percent--is high pressure welded line operated and maintained by the Central European pipeline system (CEPS). This latter portion requires a modified factor for repair since the pipeline operating infrastructure will be responsible for repair and welding of the pipe itself, while the Army engineers will support this task by excavating, clearing, and where necessary, leveling the site of damage. Adjustment for this is made by simply subtracting the vertical portion of the effort from the factor.

3. Computation: Figure E-1 shows the method of adjustment and the manhour requirements generated by the restoration of a series of bomb damage segments, totaling 1 mile.

PIPELINE REPAIR--1 MILE (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
0.11 mile, bolted pipe	54	120	108	282
0.89 mile, welded pipe	437	0*	874	1,311
0.06 pumping station**	7	41	21	69
Total	498	161	1,003	1,662

*A total of 973 manhours are expected to be accomplished by the operating commands and are not counted in this figure.

**AFCS Installation PD 1159-POL, Pipeline Pumping Station, 8-inch line (Temperate Climate).

Figure E-1

4. Method Modifications for SWA: Method modifications consist first of the substitution of desert environmental factors for the temperate factors used in NATO Europe. These increase work times by a factor of 1.15. Secondly, a major adjustment is made since by 1986 new types of pipe (grooved alumimum with quick couplings) are expected to be used in the SWA area of operations. Discussions with current authorities in pipeline developments point to the following:[2]

a. Replacement of the pipe itself will be done by quartermaster (QM) troops. New materiel will facilitate this work.

b. Crater and landslide reduction, debris removal, and other site work will be done by engineers.

c. The simplest and most accurate method of adapting repair facilities to the current set-up is to delete the vertical effort component from the factor (considering that this is accomplished by QM personnel) and retain as engineer effort the horizontal and general manhour and equipment-hour components.

5. Computation. Figure E-2 shows the engineer manhour requirements for pipeline repair.

6. Method Modification for NEA: Manhour requirements are derived similarly for those for NATO Europe in that temperate zone factors are used. However, in NEA the total length of pipeline is of the welded type, some of which

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[2] Telephone conversation between ESC staff members and:

Major Von Szilassy, Belvoir Research and Development Center, Fort Belvoir, 664-5844

Major Guillermo Giandoni, US Army Facility QM School Fort Lee, 687-804-3071

Mr. Chris Perent, US Army QM School Fort Lee, 687-804-3066

Mr. Fred Steinman, Army Facility Component School Huntsville, 205-895-5312

LTC Robert Carlyle, 416th Engineer Command Chicago Illinois 713-263-2199

is buried. The pipeline is operated and maintained by the Petroleum Distribution System, Korea; but unlike NATO, the operating command does not have the manpower to deal with wartime repair of the pipe itself, therefore the engineers will deal with this repair as well as performing excavation, clearing, and compaction at the worksites. The damage repair of the pipe itself would not be accomplished by the highly technical method of full penetration welding, but through the use of "PLIDCO" or equivalent type of pipe clamps, which would be reinforced by a "fill-it" weld. In this area the frequency of pumping stations is greatly reduced.

PIPELINE REPAIR--1 MILE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 12520 AC (Desert) x 5.28 (5.28 gaps of 200 ft = 0.2 miles)	106	--*	185	291
Facility No. 12520 AB (Desert) x 10.56 (10.56 gaps of 200 ft = 0.4 mile)	222	--*	370	592
Facility No. 1250AA (Desert) x 10.56 (10.56 gaps of 200 ft = 0.4 miles)	243	--*	581	824
0.06 Pumping Station**	8	47	24	79
Total	579	47	1,160	1,786

*A total of 1,262 manhours are expected to be accomplished by QM forces and are not counted in this figure.

**AFCS installation PD 1039-POL, Pipeline Pumping Station, 8-inch line (Desert Climate).

Figure E-2

7. Computation: The following figure (Figure E-3) shows the engineer manhour requirements for pipeline repair.

PIPELINE REPAIR--1 MILE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 12520 AC (Temperate) x 5.28 (5.28 gaps of 200 ft = 0.2 miles)	90	195	185	248
Facility No. 12520 AB (Temperate) x 10.56 (10.56 gaps of 200 ft = 0.4 miles)	190	391	317	507
Facility No. 1250AA (Temperate) x 10.56 (10.56 gaps of 200 ft = 0.4 miles)	211	507	507	718
0.01 Pumping Station*	1	7	3	11
Total	492	1,100	985	1,483

*AFCS installation PD 1039-POL, Pipeline Pumping Station, 8-inch line, (Temperate Climate).

Figure E-3

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TAB F

TASK 6: DAMAGE REPAIR TO PORTS (WHARVES AND PIERS)

TAB F

TASK 6: DAMAGE REPAIR TO PORTS (WHARVES AND PIERS)

Engineer Workload Factors:

a. Europe.

Total Task:	10.9 Manhours/Ton/Day Capacity
Skilled Engineer Effort:	8.4 Manhours/Ton/Day Capacity
Unskilled Effort:	2.5 Manhours/Ton/Day Capacity

b. SWA.

Total Task:	16.6 Manhours/Ton/Day Capacity
Skilled Engineer Effort:	12.8 Manhours/Ton/Day Capacity
Unskilled Effort:	3.8 Manhours/Ton/Day Capacity

c. NEA.

Total Task:	12.2 Manhours/Ton/Day Capacity
Skilled Engineer Effort:	9.4 Manhours/Ton/Day Capacity
Unskilled Effort:	2.8 Manhours/Ton/Day Capacity

1. Standard of Construction: This standard is the most austere applicable to restoration of the capacity indicated. Work includes only restoration of the wharf or pier itself, and clearing of debris to permit unloading of cargo. No provision is made for access, either by road or rail, or for open or covered storage sites. No effort is provided for removal of sunken ships or channel clearance.

2. Method. Manhour requirements are derived from planning data in FM 101-10-1.[1]

a. Chapter 6 of that reference contains engineering planning data and in Section 11, Facility Construction Planning Factors, it states that a container ship wharf (one side berth only) of a length, width, and water depth (in meters) respectively of 300 x 24 x 20 will accommodate an average

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[1]Department of the Army, Headquarters, FM 101-10-1, Staff Officers' Field Manual--Organizational, Technical, and Logistic Data--UNCLASSIFIED Data, Washington, D. C., July 1976 (UNCLASSIFIED) (hereafter referred to as FM 101-10-1).

off-loading of 5,070 short tons per 20-hour day. This rate also permits reloading of empty containers.

b. Table 6-17 in FM 101-10-1 shows manhour requirements for complete rehabilitation of a 9.44- x 153.0-meter, deep-draft wharf and ancillary facilities. The total quantity of manhours for seven tasks is 39,510 manhours. For a minimum requirement, two essential tasks were selected (repair of the 153-meter-long, deep-draft wharf, and the clearing of surface debris). The total requirement of these tasks is as follows: wharf repair 25,220 manhours and debris clearing 2,500 manhours for a total of 27,720 manhours. To provide a factor for minimum clearing and repair of 300 meters of wharf as specified in subparagraph a above, this quantity is doubled to produce 55,440 manhours. Dividing this by 5,070 short tons per day yields a factor of 10.9 manhours per short ton daily capacity.

c. The proportional allocation of total manhours into horizontal, vertical, and general categories is done by using the average percentages reflected in several pier and wharf facilities in the AFCS. These are respectively: 17 percent, 60 percent, and 23 percent.

3. Computation: Figure F-1 shows the manhours of effort required to restore the operational capacity indicated to damaged wharves and piers.

4. Method Modifications for SWA: The following modifications have been made to adjust the method of estimating manhour effort requirements for wharf and pier repair to conditions which prevail in SWA.

a. An examination of several references reveals that there is, in general, a lack of container handling equipment at ports in this area.[2,3,4] There is also a lack of conveniently located deep-draft port areas. As a result, the engineer work estimate for SWA is based on the use of lighterage wharves.

WHARF AND PIER REPAIR (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Repair 153-Meter Wharf				25,200
Clearing Debris				2,500
Total Minimum Restoration				27,720
x 2.0 for 300-Meter Wharf*				55,440
Manhours/Ton/Day**	1.8	6.6	2.5	10.9

*To provide 5,070 short tons/day capacity.

**Type effort allocations are made on an approximate average of several similar tasks in AFCS facilities.

Figure F-1

b. Table 6-18 in FM 101-10-1 shows the manhour requirements for rehabilitation of a 10.66-meter x 152.40-meter lighterage wharf. As was done above for the NATO deep-draft wharf, the two essential tasks were extracted (repair of the wharf itself, and debris clearance). Wharf repair requires 11,960 manhours and debris clearance 2,500 manhours for a total of 14,460 manhours.

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[2]Defense Intelligence Agency, Integrated Operational Support Study, Middle East and Arabian Peninsula (U), Volume 1, May 1981, (SECRET-NOCONTRACT/NOFORN/WNINTEL).

[3]Defense Intelligence Agency, Integrated Operational Study, Arabian Peninsula (U), Volume II, May 1979, (SECRET-NOCONTRACT/NOFORN/WNINTEL).

[4]Third United States Army, Headquarters, Fort McPherson, Georgia, Deployment to Southwest Asia: Mobility Considerations (U), December 1984, (SECRET-NOFORN).

c. To account for work done in a desert environment, the factor is multiplied by 1.15 to yield 16,629 manhours.

d. Table 4-1, "Capacities of Transportation Modes," Chapter 4 of FM 101-10-1, shows that lighterage from one ship at a time, with adequate lighterage available, may equal 1,000 short tons per day. This figure is accepted as average for the wharf repaired in this factor.

5. Computation: Figure F-2 shows the manhours of effort required to restore a damaged lighterage wharf.

WHARF AND PIER REPAIR (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Repair 152.4-Meter Lighterage Wharf				11,960
Clearing Debris				2,500
Total Minimum Restoration				14,460
x 1.15 for Desert Climate*				16,629
Manhours/Ton/Day**	2.8	10.0	3.8	16.6

*To provide average 1,000 short ton/day capacity.
**Type effort allocations are made on an approximate average of several similar tasks in AFCS facilities.

Figure F-2

6. Method Modifications for NEA: The following adjustments have been made to the method of estimating wharf and pier damage repair to more closely approximate conditions likely to be encountered in NEA.

a. Currently, there are at least 4 to 5 ports at which facilities exist for containerized cargo. As time passes, more ports will be improved by the addition of containerized facilities.

b. For purposes of development of these damage repair factors, it was assumed that 65 percent of the wharves requiring repair are equipped for

container handling like those used in the NATO area, and that the remaining 35 percent are wharves generally similar to those used in SWA.[5,6] Lighterage may or may not be employed. The typical wharf is that described in Table 6-18 of FM 101-10-1. Climatic conditions are temperate.

7. Computation: Figure F-3 shows the manhour effort required to repair the composite wharf described below.

WHARF AND PIER REPAIR (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Manhours/Ton/Day (Container Wharf)	1.8	6.6	2.5	10.9
x 0.65	1.17	4.29	1.625	7.085
Manhours/Ton/Day (Lighterage Wharf)	2.5	8.7	3.3	14.5
x 0.35	0.875	3.045	1.155	5.075
Manhours/Ton/Day (NEA)	2.1	7.3	2.8	12.2

Figure F-3

[5]Defense Mapping Agency, Publication 150, World Port Index, 1982.

[6]Conversation between ESC staff members and Mr. Paul D. Troxler, Port Engineer, Port of Savanna, Georgia.

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TAB G

TASK 7: DAMAGE REPAIR TO ARMY AIRFIELDS

TAB G

TASK 7: DAMAGE REPAIR TO ARMY AIRFIELDS

Engineer Workload Factors:

a.	Europe.	
	Total Task:	1,788 Manhours/Airfield Restored
	Skilled Engineer Effort:	1,305 Manhours/Airfield Restored
	Unskilled Effort:	483 Manhours/Airfield Restored
b.	SWA.	
	Total Task:	2,057 Manhours/Airfield Restored
	Skilled Engineer Effort:	1,501 Manhours/Airfield Restored
	Unskilled Effort:	556 Manhours/Airfield Restored
c.	NEA.	
	Total Task:	1,788 Manhours/Airfield Restored
	Skilled Engieer Effort:	1,305 Manhours/Airfield Restored
	Unskilled Effort:	483 Manhours/Airfield Restored

1. Standard of Construction: The standard of construction adopted for this task is the most austere level compatible with restoration of air activity at a damaged Army airfield.

2. Method: Manhour requirements are developed by employing a combination of four applicable facilities from the AFCS and a single task taken from E-FOSS. The assignment of these facilities permits a breakout of the various types of skilled and unskilled effort which make up the repair task. The AFCS facilities and the E-FOSS task are enumerated as follows:

a. Facility No. 11150 AE provides installation of aluminum landing mat (125,000 square feet).

b. Facility No. 12110 AN provides a fueling facility.

c. Facility No. 13610 AA provides an airfield lighting set for a runway.

d. Facility No. 13315 BA provides a wood frame control tower.

e. The E-FOSS Tasks No. 10 and 11 provides for filling and compacting bomb craters.

3. Computation: Figure G-1 shows the manhour requirements to repair a totally damaged Army airfield.

ARMY AIRFIELD REPAIR (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 11150 AE (Landing Mat)	32	--	326	358
Facility No. 12110 AN (Fuel)	60	--	--	60
Facility No. 13610 AA (Lights)	--	84	60	144
Facility No. 13315 BA (Tower)	1	487	97	585
E-FOSS Tasks No. 10 and 11 (50 craters)	641	--	--	641
Total	734	571	483	1,788

Figure G-1

4. Method Modifications for SWA: For this area the same combination of four facilities from the AFCS and the crater task from E-FOSS are used to repair a damaged Army airfield. However, desert facilities are substituted in SWA and the effort factor for crater repair is multiplied by 1.15 to allow for desert conditions.

5. Computation: Figure G-2 shows the manhour requirements for an airfield repair. This repair restores minimum operational capability to the damaged field.

6. Method Modifications for NEA: The adaptation of the NATO airfield repair effort factor for NEA requires no significant modifications.

7. Computation: Figure G-3 shows the manhour requirements for airfield damage repair.

ARMY AIRFIELD REPAIR (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 11150 AE (Landing Mat)	37	--	375	412
Facility No. 12110 AN (Fuel)	69	--	--	69
Facility No. 13610 AA (Lights)	--	97	69	166
Facility No. 13315 BA (Tower)*	1	560	112	673
E-FOSS Tasks No. 10 and 11 (50 Craters)	737	--	--	737
Total	844	657	556	2,057

*This facility appears in the AFCS catalogue (TM 5-301) for Temperate Climate, but does not appear in that for Desert Climate. For purposes of development of this factor, the facility for Temperate Climate is multiplied by 1.15 to account for desert conditions.

Figure G-2

ARMY AIRFIELD REPAIR (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 11150 AE (Landing Mat)	32	--	326	358
Facility No. 12110 AN (Fuel)	60	--	--	60
Facility No. 13610 AA (Lights)	--	84	60	144
Facility No. 13315 BA (Tower)	1	487	97	585
E-FOSS Tasks No. 10 and 11 (50 craters)	641	--	--	641
Total	734	571	483	1,788

Figure G-3

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TAB H

TASK 8: TROOP CAMP CONSTRUCTION

TAB H

TASK 8: TROOP CAMP CONSTRUCTION

Engineer Workload Factors:

	Manhours Per Man in Camp		
	Europe	NEA	SWA
Total Task:	8.8	14.9	17.1
Skilled Engineer Effort:	5.8	10.4	12.0

1. Standard of Construction: This installation is the most austere level available within the AFCS. It is classified as an initial standard. Accommodations are in tents with earth floors. Erection is performed by users, requiring no engineer effort.

2. Method: The AFCS uses a modular system for its troop camp designs. Designs are prepared for 125-man, 250-man, and 375-man camps. Larger camps are aggregations of these basic units. The 375-man camp, AFCS Installation NT 1221, is used as the basis of the engineer workload factor as it is the most efficient with respect to manhours of construction effort per man in camp.[1] Differences in the factors for the European, NEA, and SWA areas are based on differences in climate and terrain.

3. Computation:

a. Construction manhours. Figures H-1, H-2, and H-3 show for Europe, NEA, and SWA, respectively, the derivation of manhour requirements for construction of the 375-man troop camp.

[1] Department of the Army, US Army Corps of Engineers, Office of the Chief of Engineers, TM 5-302, Army Facilities Components System Designs, Washington, D. C., Change 4 dated 1985 (UNCLASSIFIED) (hereafter referred to as TM 5-302).

MANHOUR REQUIREMENTS FOR 375-MAN TROOP CAMP—EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	3	11	33	100	300	156	468	801
Site Preparation	acre	87190 AA	8.8	88	774	0	0	32	282	1,056
Road, graded & drained	mile	85130 FD	0.09	2,265	204	0	0	905	81	285
Road Surface	mile	85110 BM	0.09	189	17	0	0	64	6	23
Hardstand, graded & drained	1,000 SY	85210 AY	3.5	215	753	0	0	77	269	1,022
Hardstand Surface	1,000 SY	85110 DF	3.5	24	84	0	0	8	28	112
TOTAL					1,865		300		1,134	3,299

Figure H-1

MANHOUR REQUIREMENTS FOR 375-MAN TROOP CAMP—NEA
(Temperate Climate, Mountainous Grassland With Moderate Rock)

Facility				Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	3	11	33	100	300	156	468	801
Site Preparation	acre	87190 AA	8.8	88	774	0	0	32	282	1,056
Road, graded & drained	mile	85130 FW	0.09	6,850	617	0	0	2,719	245	862
Road Surface	mile	85110 BM	0.09	189	17	0	0	64	6	23
Hardstand, graded & drained	1,000 SY	85210 BR	3.5	594	2,079	0	0	184	644	2,723
Hardstand Surface	1,000 SY	85110 DF	3.5	24	84	0	0	8	28	112
TOTAL					3,604		300		1,673	5,577

Figure H-2

MANHOUR REQUIREMENTS FOR 375-MAN TROOP CAMP—SWA
(Desert Climate, Mountainous Grassland With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	3	13	39	115	345	179	537	921
Site Preparation	acre	87190 AA	8.8	101	889	0	0	37	326	1,215
Road, graded & drained	mile	85130 FW	0.09	7,878	709	0	0	3,127	281	990
Road Surface	mile	85110 BM	0.09	217	20	0	0	74	7	27
Hardstand, graded & drained	1,000 SY	85210 BR	3.5	683	2,391	0	0	212	742	3,133
Hardstand Surface	1,000 SY	85110 DF	3.5	28	98	0	0	9	32	130
TOTAL					4,146		345		1,925	6,416

Figure H-3

b. Manhours per man in camp:

Theater	Installation Requirement (Manhours) Total	Skilled	Camp Capacity	Workload Factor (Manhours/Man) Total	Skilled
Europe	3,299	2,165	375	8.8	5.8
NEA	5,577	3,904	375	14.9	10.4
SWA	6,416	4,491	375	17.1	12.0

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TAB I

TASK 9: ADMINISTRATIVE SPACE CONSTRUCTION

TAB I

TASK 9: ADMINISTRATIVE SPACE CONSTRUCTION

Engineer Workload Factors:

	Manhours Per Man in COMMZ		
	Europe	NEA	SWA
Total Task:	3.5	4.0	4.5
Skilled Engineer Effort:	2.9	3.3	3.7

1. Standard of Construction: These installations are the most austere level available within the AFCS system and are classified as a transitional standard. Wood-frame buildings are used. Motor pools and utilities other than electricity have been omitted.

2. Method: The administrative headquarters are assumed to be divided equally between 10,000-square-foot and 25,000-square-foot installations. To obtain an average manhour per square foot requirement, the manhour requirements for the 10,000-square-foot installation are multiplied by 2.5, the product added to the manhour requirements for the 25,000-square-foot installation, and the sum divided by 50,000. The 10,000-square-foot installation is AFCS Facility No. AA1021; the 25,000-square-foot installation is AFCS Facility No. AA1061.[1] Requirements for square feet of space per man in COMMZ are derived from classified figures in the Force Planning Activities Europe.[2] Manhours of effort per man in COMMZ is the product of manhours per square foot and square feet per man. It is assumed that 30 percent of the requirement is met by new construction, that 70 percent will be met by repair/renovation of existing facilities, and that the repair/renovation effort requires 20 percent of the

[1] TM 5-302, Change 4, Drawing AA1011-1121.
[2] Force Planning Activities Europe.

effort required for new construction. Differences among the factors for Europe, NEA, and SWA result from differences in climate and terrain.

3. Computation:

a. Construction manhours. Manhour requirements to construct the 10,000-square-foot installation are developed in Figure I-1 for Europe, in Figure I-2 for NEA, and in Figure I-3 for SWA. Manhour requirements to construct the 25,000-square-foot installation are developed in Figure I-4 for Europe, Figure I-5 for NEA, and in Figure I-6 for SWA.

b. Manhours per man in COMMZ are developed in Figure I-7, using a requirement of 6.2 square feet per man in COMMZ.

MANHOUR REQUIREMENTS FOR 10,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—EUROPE
(Temperate Climate, Rolling Wooded Terrain With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Admin HQ Bldg	30 x 70 ft	61050 BT	1	175	175	4,489	4,489	846	846	5,510
Admin Support Bldg	30 x 70 ft	61050 BW	4	50	200	925	3,700	190	760	4,660
Latrine	10 x 20 ft	72321 BD	2	2	4	200	400	32	64	468
Storehouse	20 x 20 ft	44110 BE	1	23	23	262	262	53	53	338
Hardstand	1,000 SY	85210 AY	4.3	215	925	0	0	77	331	1,256
Hardstand Surface	1,000 SY	85110 DF	4.3	24	103	0	0	8	34	137
Road	1 mile	85130 FD	.02	2,265	45	0	0	905	18	63
Road Surface	1 mile	85110 BN	.02	241	5	0	0	68	1	6
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
Site Prep	acres	87190 AA	5.15	88	453	0	0	32	165	618
Electrical Distr		81240 BK	1	48	48	524	524	16	16	588
TOTAL					1,997		9,483		2,404	13,884

Figure I-1

MANHOUR REQUIREMENTS FOR 10,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Admin HQ Bldg	30 x70 ft	61050 BT	1	175	175	4,489	4,489	846	846	5,510
Admin Support Bldg	30 x 70 ft	61050 BW	4	50	200	925	3,700	190	760	4,660
Latrine	10 x 20 ft	72321 BD	2	2	4	200	400	32	64	468
Storehouse	20 x 20 ft	44110 BE	1	23	23	262	262	53	53	338
Hardstand	1,000 SY	85210 BR	4.3	594	2,554	0	0	184	791	3,345
Hardstand Surface	1,000 SY	85110 DF	4.3	24	103	0	0	8	34	137
Road	1 mile	85130 FW	.02	6,850	137	0	0	2,719	54	191
Road Surface	1 mile	85110 BN	.02	241	5	0	0	68	1	6
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
Site Preparation	acre	87190 AA	5.15	88	453	0	0	32	165	618
Electrical Distr		81240 BK	1	48	48	524	524	16	16	588
TOTAL					3,718		9,483		2,900	16,101

Figure I-2

MANHOUR REQUIREMENTS FOR 10,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Item	Facility Size or Unit	Facility AFCS Number	Quantity	Manhours Horizontal Unit	Manhours Horizontal Net	Manhours Vertical Unit	Manhours Vertical Net	Manhours General Unit	Manhours General Net	Total
Admin HQ Bldg	30 x 70 ft	61050 BT*	1	201	201	5,162	5,162	973	973	6,336
Admin Support Bldg	30 x 70 ft	61050 BW*	4	58	232	1,063	4,252	219	876	5,360
Latrine	10 x 20 ft	72321 BD	2	2	4	230	460	37	74	538
Storehouse	20 x 20 ft	44110 BE	1	26	26	301	301	61	61	388
Hardstand	1,000 SY	85210 BR	4.3	683	2,937	0	0	212	912	3,849
Hardstand Surface	1,000 SY	85110 DF	4.3	28	120	0	0	9	39	159
Road	1 mile	85130 FW	.02	7,878	158	0	0	3,127	63	221
Road Surface	1 mile	85110 BN	.02	277	6	0	0	78	2	8
Sump, Fire	10,000 gal	84330 AC	1	18	18	124	124	133	133	275
Site Preparation	acre	87190 AA	5.15	101	520	0	0	37	191	711
Electrical Distr		81240 BK	1	55	55	603	603	18	18	676
TOTAL					4,277		10,902		3,342	18,521

*These facilities are not listed in FM 5-301 for Desert Climate. Manhour requirements are estimated by applying a factor of 1.15 to the Temperate Climate requirement.

Figure I-3

MANHOUR REQUIREMENTS FOR 25,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—EUROPE
(Temperate Climate, Rolling Wooded Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Admin HQ Bldg	30 x 70 ft	61050 BT	2	175	350	4,489	8,978	846	1,692	11,020
Admin Support Bldg	30 x 70 ft	61050 BW	8	50	400	925	7,400	190	1,520	9,320
Admin HQ Bldg	30 x 70 ft	61050 BR	1	105	105	2,225	2,225	470	470	2,800
Admin Support Bldg	30 x 50 ft	61050 BY	2	35	70	800	1,600	140	280	1,950
Latrine	10 x 20 ft	72321 BD	3	2	6	200	600	32	96	702
Storehouse	20 x 50 ft	44110 BA	1	32	32	461	461	136	136	629
Hardstand	1,000 SY	85210 AY	4.78	215	103	0	0	77	368	471
Hardstand Surface	1,000 SY	85110 DF	4.78	24	115	0	0	8	38	153
Road	1 mile	85130 FD	0.02	2,265	45	0	0	905	18	63
Road Surface	1 mile	85110 BN	0.02	241	5	0	0	68	1	6
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
Site Preparation	1 acre	87190 AA	7.13	88	627	0	0	32	228	855
Electrical Distr		81240 BL	1	48	48	474	474	98	98	620
TOTAL					1,922		21,846		5,061	28,829

Figure I-4

MANHOUR REQUIREMENTS FOR 25,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Admin HQ Bldg	30 x 70 ft	61050 BT	2	175	350	4,489	8,978	846	1,692	11,020
Admin Support Bldg	30 x 70 ft	61050 BW	8	50	400	925	7,400	190	1,520	9,320
Admin HQ Bldg	30 x 70 ft	61050 BR	1	105	105	2,225	2,225	470	470	2,800
Admin Support Bldg	30 x 50 ft	61050 BY	2	35	70	800	1,600	140	280	1,950
Latrine	10 x 20 ft	72321 BD	3	2	6	200	600	32	96	702
Storehouse	20 x 50 ft	44110 BA	1	32	32	461	461	136	136	629
Hardstand	1,000 SY	85210 BR	4.78	594	2,839	0	0	184	880	3,719
Hardstand Surface	1,000 SY	85110 DF	4.78	24	115	0	0	8	38	153
Road	1 mile	85130 FW	0.02	6,850	137	0	0	2,719	54	191
Road Surface	1 mile	85110 BN	0.02	241	5	0	0	68	1	6
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
Site Preparation	1 acre	87190 AA	7.13	88	627	0	0	32	228	855
Electrical Distr		81240 BL	1	48	48	474	474	98	98	620
TOTAL					4,750		21,846		5,609	32,205

Figure I-5

MANHOUR REQUIREMENTS FOR 25,000-SQUARE-FOOT ADMINISTRATIVE HEADQUARTERS—SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	APCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Admin HQ Bldg	30 x 70 ft	61050 BT*	2	201	402	5,162	10,324	973	1,946	12,672
Admin Support Bldg	30 x 70 ft	61050 BW*	8	58	464	1,063	8,504	219	1,752	10,720
Admin HQ Bldg	30 x 70 ft	61050 BR*	1	121	121	2,559	2,559	541	541	3,221
Admin Support Bldg	30 x 50 ft	61050 BY*	2	40	80	920	1,840	161	322	2,242
Latrine	10 x 20 ft	72321 BD	3	2	6	230	690	37	111	807
Storehouse	20 x 50 ft	44110 BA	1	37	37	530	530	156	156	723
Hardstand	1,000 SY	85210 BR	4.78	683	3,265	0	0	212	1,013	4,278
Hardstand Surface	1,000 SY	85110 DF	4.78	28	134	0	0	9	43	177
Road	1 mile	85130 FW	0.02	7,878	158	0	0	3,127	62	220
Road Surface	1 mile	85110 BN	0.02	277	6	0	0	78	2	8
Sump, Fire	10,000 gal	84330 AC	1	18	18	124	124	133	133	275
Site Preparation	1 acre	87190 AA	7.13	101	737	0	0	37	264	1,001
Electrical Distr		81240 BL*	1	55	55	545	545	113	113	713
TOTAL					5,483		25,116		6,458	37,057

*These facilities are not listed in FM 5-301 for Desert Climate. Manhour requirements are estimated by applying a factor of 1.15 to the Temperate Climate requirement.

Figure I-6

MANHOURS PER MAN IN COMMZ

	Europe		NEA		SWA	
	Total	Skilled	Total	Skilled	Total	Skilled
1. Manhours for 10,000 SF Installation	13,884	11,480	16,101	13,201	18,521	15,179
2. x 2.5	34,710	28,700	40,253	33,003	46,303	37,948
3. Manhours for 25,000 SF Installation	28,829	23,768	32,205	26,596	37,057	30,599
4. Sum of Lines 2 and 3	63,539	52,468	72,458	59,599	83,360	68,547
5. ÷ 50,000 → Average Manhours/SF	1.27	1.05	1.45	1.19	1.67	1.37
6. x .70 x .20 → Manhours/SF of Repair/Renovation	0.18	0.15	0.20	0.17	0.23	0.19
7. Line 5 x .30 → Manhours/SF of New Construction	0.38	0.32	0.44	0.36	0.50	0.41
8. Sum of Lines 6 and 7 → Total Manhours/SF	0.56	0.47	0.64	0.53	0.73	0.60
9. x 6.2 Sq Ft/Man → Manhours/Man	3.5	2.9	4.0	3.3	4.5	3.7

Figure I-7

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TAB J

TASK 10: GENERAL SUPPLY STORAGE CONSTRUCTION

TAB J

TASK 10: GENERAL SUPPLY STORAGE CONSTRUCTION

Engineer Workload Factors:

	Manhours/STON		
	Europe	NEA	SWA
Total Task:	3.5	4.0	4.6
Skilled Engineer Effort:	2.6	3.0	3.4

1. Standard of Construction: These installations are the most austere available within the AFCS system. Both covered and open storage installations are classified as a transitional standard. The covered storage uses wood-frame storehouses. Latrines, roads, hardstands, and fire protection sumps are included in both storage installations.

2. Method: FM 101-10-1 gives, for all classes of supply except V, the consumption rate in pounds per man per day, the gross storage requirement in square feet per man per day, and the percentage of covered versus open storage.[1] Eliminating the man per day common denominator and applying the percentages gives pounds per square foot of covered and open storage. Manhours per square foot for covered and open storage are derived from 100,000-square-foot AFCS installations.[2,3] Pounds per square foot are converted to tons per square foot and combined with manhours per square foot to arrive at manhours per STON. Differences among the three areas result from differences in climate and terrain.

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[1] FM 101-10-1, paragraph 6-5i; factors verified in telephone conversation 14 May 1985 between ESC staff members and COL Howard Daniel, Supply and Maintenance Policy Division, ODCSLOG, DA.

[2] TM 5-302; Installation DC 1131 on drawing DC 1001-1151.

[3] TM 5-302; Installation DC 1189 on drawing DC 1169-1219.

3. Computation:

a. Consumption in pounds per man per day and storage requirement in square feet per man per day are developed in Figure J-1, for both covered and open storage.

CONSUMPTION AND STORAGE

Class	Percent Covered	Consumption--lb/man/day			Storage--SF/man/day		
		Gross	Covered	Open	Gross	Covered	Open
I	100	5.49	5.49	0	0.0469	0.0469	0
II	60	3.26	1.956	1.304	0.0169	0.01014	0.00676
III	3	1.86	0.0558	1.8042	0.0005	0.000015	0.000485
IV	10	8.50	0.85	7.65	0.0073	0.00073	0.00657
VI	90	3.20	2.88	0.32	0.0248	0.02232	0.00248
VII	15	4.27	0.6405	3.6295	0.0055	0.00825	0.004675
VIII	90	0.35	0.315	0.0315	0.0054	0.00486	0.00054
IX	58	1.52	0.8816	0.6384	0.0077	0.004466	0.003234
TOTAL		28.45	13.0689	15.3776	0.1150	0.090256	0.024744

Figure J-1

b. Conversion:

Tons per square foot of covered storage = 13.0689 ÷ 2,000 ÷ 0.090256 = 0.072

Tons per square foot of open storage = 15.3776 ÷ 2,000 ÷ 0.024744 = 0.311

Percentage of covered storage by weight = 13.0689 ÷ 28.45 = 46%

Percentage of open storage by weight = 15.3776 ÷ 28.45 = 54%

c. Manhour requirements for 100,000 square feet of covered storage are developed in Figure J-2 for Europe, Figure J-3 for NEA, and Figure J-4 for SWA.

MANHOURS FOR 100,000-SQUARE-FEET OF COVERED STORAGE—EUROPE
(Temperate Climate, Rolling Woodland Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Latrine	10 x 20 ft	72321 BD	2	2	4	200	400	32	64	468
Storehouse	48 x 96 x 14 ft	44110 BC	4	70	280	1,516	6,064	561	2,244	8,588
Storehouse	80 x 224 x 14 ft	44110 BD	5	198	990	5,476	27,380	2,096	10,480	38,850
Hardstand, graded & drained	1,000 SY	85210 AY	7.5	215	1,793	0	0	77	637	2,430
Hardstand Surface	1,000 SY	85110 DF	7.5	24	180	0	0	8	60	240
Road	mile	85130 FD	0.3	2,265	680	0	0	905	272	952
Road Surface	mile	85110 BN	0.3	241	81	0	0	68	20	101
Sump, fire	10,000 gal	84330 AC	2	16	32	108	216	116	232	480
Site Preparation	acre	87190 AA	15.8	88	1,390	0	0	32	505	1,895
TOTAL					5,430		34,060		14,514	54,004

Figure J-2

MANHOURS FOR 100,000-SQUARE-FEET OF COVERED STORAGE--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Latrine	10 x 20 ft	72321 BD	2	2	4	200	400	32	64	468
Storehouse	48 x 96 x 14 ft	44110 BC	4	70	280	1,516	6,064	561	2,244	8,588
Storehouse	80 x 224 x 14 ft	44110 BD	5	198	990	5,476	27,380	2,096	10,480	38,850
Hardstand	1,000 SY	85210 BR	7.5	594	4,455	0	0	184	1,380	5,835
Hardstand Surface	1,000 SY	85110 DF	7.5	24	180	0	0	8	60	240
Road	mile	85130 FW	0.3	6,850	2,055	0	0	2,719	816	2,871
Road Surface	mile	85110 BN	0.3	241	81	0	0	68	20	101
Sump, Fire	10,000 gal	84330 AC	2	16	32	108	216	116	232	480
Site Preparation	acre	87190 AA	15.8	88	1,390	0	0	32	505	1,895
TOTAL					9,467		34,060		15,801	59,328

Figure J-3

MANHOURS FOR 100,000-SQUARE-FEET OF COVERED STORAGE--SWA
(Desert Climate, Mountainous Terrain With Moderate Rock)

	Facility			Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Latrine	10 x 20 ft	72321 BD	2	2	4	230	460	37	74	538
Storehouse	48 x 96 x 14 ft	44110 BC	4	81	324	1,743	6,972	645	2,580	9,876
Storehouse	80 x 224 x 14 ft	44110 BD	5	228	1,140	6,297	31,485	2,410	12,050	44,675
Hardstand	1,000 SY	85210 BR	7.5	683	5,123	0	0	212	1,590	6,713
Hardstand Surface	1,000 SY	85110 DF	7.5	28	210	0	0	9	68	278
Road	mile	85130 FW	0.3	7,878	2,363	0	0	3,127	938	3,301
Road Surface	mile	85110 BN	0.3	277	83	0	0	78	23	106
Sump, Fire	10,000 gal	84330 AC	2	18	36	124	248	133	266	550
Site Preparation	acre	87190 AA	15.8	101	1,596	0	0	37	585	2,181
TOTAL					10,879		39,165		18,174	68,218

Figure J-4

d. Manhour requirements for 100,000 square feet of open storage are developed in Figure J-5 for Europe, Figure J-6 for NEA, and Figure J-7 for SWA.

e. Figures J-8, J-9, and J-10 develop manhours per ton for Europe, NEA, and SWA, respectively, by dividing manhours per square foot by tons per square foot separately for covered and open storage. They then combine covered and open storage by adding them in their percentages by weight.

MANHOURS FOR 100,000-SQUARE-FEET OF OPEN STORAGE—EUROPE
(Temperate Climate, Rolling Woodland Terrain With Moderate Rock)

	Facility			Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Administration Tent	16 x 32 ft	72520 AA	0.1	0	0	0	0	40	4	4
Latrine	10 x 20 ft	72321 BD	1	2	2	200	200	32	32	234
Hardstand	1,000 SY	85210 AY	11.2	215	2,408	0	0	77	862	3,270
Road	mile	85130 FD	0.5	2,265	1,133	0	0	905	452	1,585
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
TOTAL					3,559		308		1,466	5,333

Figure J-5

MANHOURS FOR 100,000-SQUARE-FEET OF OPEN STORAGE—NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Item	Facility			Manhours						
	Size or Unit	AFCS Number	Quantity	Horizontal		Vertical		General		
				Unit	Net	Unit	Net	Unit	Net	Total
Administration Tent	16 x 32 ft	72520 AA	0.1	0	0	0	0	40	4	4
Latrine	10 x 20 ft	72321 BD	1	2	2	200	200	32	32	234
Hardstand	1,000 SY	85210 BR	11.2	594	6,653	0	0	184	2,061	8,714
Road	mile	85130 FW	0.5	7,622	3,811	0	0	3,019	1,506	5,317
Sump, Fire	10,000 gal	84330 AC	1	16	16	108	108	116	116	240
TOTAL					10,482		308		3,719	14,509

Figure J-6

MANHOURS FOR 100,000-SQUARE-FEET OF OPEN STORAGE—SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Item	Facility			Manhours						
	Size or Unit	AFCS Number	Quantity	Horizontal		Vertical		General		
				Unit	Net	Unit	Net	Unit	Net	Total
Administration Tent	16 x 32 ft	72520 AA	0.1	0	0	0	0	46	5	5
Latrine	10 x 20 ft	72321 BD	1	2	2	230	230	37	37	269
Hardstand	1,000 SY	85210 BR	11.2	683	7,650	0	0	212	2,374	10,024
Road	mile	85130 FW	0.5	7,878	3,939	0	0	3,127	1,564	5,503
Sump, Fire	10,000 gal	84330 AC	1	18	18	124	124	133	133	275
TOTAL					11,609		354		4,113	16,076

Figure J-7

MANHOURS PER TON—EUROPE

Type of Labor	Covered Storage					Open Storage					Combined Manhours/ Ton
	Manhours/ SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	Manhours SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	
Horizontal	0.05430	0.072	0.754	46	0.35	0.01837	0.311	0.059	54	0.03	0.38
Vertical	0.34060	0.072	4.730	46	2.17	0.00308	0.311	0.010	54	0.01	2.18
General	0.14514	0.072	2.016	46	0.93	0.00839	0.311	0.027	54	0.01	0.94
TOTAL	0.54004	0.072	7.500	46	3.45	0.02984	0.311	0.096	54	0.05	3.50

Figure J-8

MANHOURS PER TON—NEA

Type of Labor	Covered Storage					Open Storage					
	Manhours/ SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	Manhours SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	Combined Manhours/ Ton
Horizontal	0.09467	0.072	1.315	46	0.60	0.10482	0.311	0.337	54	0.18	0.78
Vertical	0.34060	0.072	4.730	46	2.18	0.00308	0.311	0.010	54	0.01	2.19
General	0.15801	0.072	2.195	46	1.01	0.03719	0.311	0.120	54	0.06	1.07
TOTAL	0.59328	0.072	8.240	46	3.79	0.14509	0.311	0.467	54	0.25	4.04

Figure J-9

MANHOURS PER TON—SWA

Type of Labor	Covered Storage					Open Storage					
	Manhours/ SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	Manhours SF	Tons/ SF	Manhours/ Ton	Percent By Weight	Portion of Total Manhours/ Ton	Combined Manhours/ Ton
Horizontal	0.10879	0.072	1.511	46	0.70	0.11609	0.311	0.373	54	0.20	0.90
Vertical	0.39165	0.072	5.440	46	2.50	0.00354	0.311	0.011	54	0.01	2.51
General	0.18174	0.072	2.524	46	1.16	0.04113	0.311	0.132	54	0.07	1.23
TOTAL	0.68218	0.072	9.475	46	4.36	0.16076	0.311	0.516	54	0.28	4.64

Figure J-10

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TAB K

TASK 11: AMMUNITION STORAGE CONSTRUCTION

TAB K

TASK 11: AMMUNITION STORAGE CONSTRUCTION

Engineer Workload Factors:

	Manhours per STON		
	Europe	NEA	SWA
Total Task:	7.1	20.6	23.7
Skilled Engineer Effort:	5.2	14.8	17.1

1. Standard of Construction: This installation is the most austere available in the AFCS system. It is classified as an initial standard. Engineer effort is used to construct hardstand, but shelter is provided by the using service with local material or paulins. Roads are graded and drained, but unsurfaced.

2. Method: The workload is extracted from AFCS Installation DA 1011, which provides for a nominal 5,000 tons of storage capacity.[1] The workload factor is obtained by dividing the total workload by 5,040, the actual capacity of the field storage units. Differences among the three areas result from differences in climate and terrain.

3. Computation: The manhour requirements are shown in Figure K-1 for Europe, K-2 for NEA, and K-3 for SWA. Manhours per STON are developed in Figure K-4.

[1] FM 5-302, change 4, Drawing DA 1011-1051, Sheet 1.

MANHOUR REQUIREMENTS--EUROPE
(Temperate Climate, Rolling Woodland Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Hardstand	1,000 SY	85210 AY	11.2	215	2,408	0	0	77	862	3,270
Road, 1 Lane	mile	85130 KH	7	1,752	12,264	0	0	639	4,473	16,737
Road, 2 Lane	mile	85130 FD	5	2,265	11,325	0	0	905	4,525	15,850
Total					25,997		0		9,860	35,857

Figure K-1

MANHOUR REQUIREMENTS--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Hardstand	1,000 SY	85210 BR	11.2	594	6,653	0	0	184	2,061	8,714
Road, 1 Lane	mile	85130 LC	7	4,840	33,880	0	0	1,887	13,209	47,089
Road, 2 Lane	mile	85130 FW	5	6,850	34,250	0	0	2,719	13,595	47,845
Total					74,783		0		28,865	103,648

Figure K-2

MANHOUR REQUIREMENTS--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Hardstand	1,000 SY	85210 BR	11.2	683	7,650	0	0	212	2,374	10,024
Road, 1 Lane	mile	85130 LC	7	5,566	38,962	0	0	2,170	15,190	54,152
Road, 2 Lane	mile	85130 FW	5	7,878	39,390	0	0	3,127	15,635	55,025
Total					86,002		0		33,199	119,201

Figure K-3

MANHOURS PER STON

	Manhours		Installation Capacity (STON)	Manhours Per STON	
	Skilled	Total Task		Skilled	Total Task
Europe	25,997	35,857	5,040	5.2	7.1
NEA	74,783	103,648	5,040	14.8	20.6
SWA	86,002	119,201	5,040	17.1	23.7

Figure K-2

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TAB L

TASK 12: REFRIGERATED STORAGE CONSTRUCTION

TAB L

TASK 12: REFRIGERATED STORAGE CONSTRUCTION

Engineer Workload Factor:

	Manhours Per Short Ton (STON) Stored		
	Europe	NEA	SWA
Total Task:	5.6	5.6	6.4
Skilled Engineer Fffort:	3.2	3.2	3.7

1. Standard of Construction: This AFCS facility is listed in TM 5-301 but is not supported by engineer drawings, or details concerning standards of construction. The AFCS data was supplied by DAEN-SG in December 1977.

2. Method: Manhours to construct 4,000-cubic-foot refrigeration facilities are provided by AFCS Facility No. 43191 AD. Cubic feet are converted to measurement tons and thence to short tons. Manhour requirements per STON are derived by dividing the manhour requirements for the facility by the building capacity in STON. Differences among the three areas are based on climate.

3. Computation:

a. Manhour requirements for Facility No. 43191 AD:

	Europe (Temperate)	NEA (Temperate)	SWA (Desert)
Horizontal	0	0	0
Vertical	96	96	110
General	72	72	83
Total	168	168	193
Skilled	96	96	110

b. Conversion of cubic feet to short tons. A measurement ton of refrigerated subsistence requires 78.4 cubic feet of storage space and weighs 0.588 STON.[1,2]

4,000 cubic feet ÷ 78.4 = 51.0 measurement tons

51.0 x 0.588 = 30 STON capacity

c. Engineer effort requirement:

	Facility Requirement (Manhours)		Facility Capacity	Manhours/STON	
	Total	Skilled	(STON)	Total	Skilled
Europe	168	96	30	5.6	3.2
NEA	168	96	30	5.6	3.2
SWA	193	110	30	6.4	3.7

[1]Department of the Navy, Naval Facilities Command, NAVFAC P-80, Facility Planning Criteria for Navy and Marine Corps Shore Installations, Alexandria, Virginia, October 1982 (UNCLASSIFIED) (hereafter referred to as NAVFAC P-80), Table 431-10 A of Change 1, 30 January 1985.

[2]NAVFAC P-80, page 400-10.

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TAB M

TASK 13: POL STORAGE CONSTRUCTION

TAB M

TASK 13: POL STORAGE CONSTRUCTION

Engineer Workload Factors:

	Manhours Per STON		
	Europe	NEA	SWA
Total Task	1.1	1.1	1.3
Skilled Engineer Effort	0.7	0.7	0.8

1. Standard of Construction: Two austere types of construction are addressed; one using bolted steel tanks and the other collapsible bladders. No construction standard for POL storage is specified in the AFCS drawings. The steel tank farm includes tanks with berms, manifolds, pumps, pipe, an administration and operations building, and security fencing. The collapsible bladder facility includes tanks with berms and stabilized gravel pads, a mobile pump unit, hose, and a concertina-type security fence. Internal roads are not provided in either installation.

2. Method: Manhour requirements are developed from AFCS installations and facilities. Engineer effort for bladder storage is taken from Facility No. 12110 AK, a rear area fueling system with a 300,000-gallon storage capacity.[1] Requirements for the bolted steel tanks are derived from AFCS Installation PB 1119, a 200,000-barrel tank farm.[2] Tank capacity in barrels is converted to gallons, and gallon capacity is converted to tons. It is assumed that the storage requirement is divided equally between steel tanks and bladders. Differences between the Europe/NEA factor and the SWA factor result from climate difference.

[1] FM 5-302, Change 4, Drawing Number 12110 AD-AM, Sheet 3.
[2] FM 5-302, Change 4, Drawing Number PB 1019 - PB 1149, Sheet 6.

3. <u>Computation</u>:

a. Manhour requirements.

(1) Bolted steel tanks. Engineer effort to construct the 200,000-barrel tank farm is developed in Figure M-1 for Europe and NEA, and in Figure M-2 for SWA.

(2) Bladders. Engineer effort to construct the 300,000-gallon fueling system facility is shown in Figure M-3.

b. Capacity in tons.

(1) Weight of POL. Figure M-4 shows the average weight of a gallon of POL to be 6.36 pounds. The weight in tons is 6.36 ÷ 2,000 = 0.00318 STON per gallon.

(2) Capacity of tank farm. At 42 gallons per barrel and 0.00318 STON per gallon, the capacity of the 200,000-barrel tank farm is 200,000 x 42 x 0.00318 = 26,712 STON.

(3) Capacity of bladder fueling system. At 0.00318 STON per gallon, the 300,000-gallon facility has a capacity of 300,000 x 0.00318 = 954 STON.

c. Manhours per STON. Figure M-5 derives and averages the manhours per STON factors.

MANHOUR REQUIREMENTS FOR 200,000-BARREL TANK FARM—EUROPE AND NEA
(Temperate Climate)

Item	Facility Size or Unit	AFCS Number*	Quantity	Manhours Horizontal Unit	Horizontal Net	Vertical Unit	Vertical Net	General Unit	General Net	Total
Tank w/8-inch line	10,000 bbl	41180 AK	19	140	2,660	850	16,150	430	8,170	26,980
Tank w/8-inch line	3,000 bbl	41180 AH	4	90	360	310	1,240	220	880	2,480
Tank, water, w/ 4 inch line	1,000 bbl	41180 AE	1	80	80	320	320	130	130	530
Tank, 250 bbl w/ 4 inch line	250 bbl	41180 AB	1	25	25	100	100	45	45	170
POL switching manifold	8" inch diameter	12510 AC	1	10	10	180	180	60	60	250
Pump station		12530 AK	2	5	10	35	70	20	40	120
Tank pump & manifold	1,400 BPH	12510 AJ	4	5	20	35	140	10	40	200
Transfer pump & manifold	1,400 BPH	12510 AP	1	35	35	245	245	50	50	330
Pipe & accessories	1,000 ft, 8-inch diameter	12510 BK	6	10	60	200	1,200	140	840	2,100
Pipe & accessories	1,000 ft, 8-inch diameter	12510.AV	1	10	10	110	110	60	60	180
Admin & Op building	20 x 40 ft	61050 BF	1	32	32	457	457	170	170	659
Fence	1,000 ft	87210 AR	5	48	240	222	1,110	224	1,120	2,470
Gate		87210 AT	2	8	16	120	240	48	96	352
TOTAL					3,558		21,562		11,701	36,821

*Facility data taken from TM 5-301.

Figure M-1

MANHOUR REQUIREMENTS FOR 200,000-BARREL TANK FARM--SWA
(Desert Climate)

Item	Facility: Size or Unit	Facility: AFCS Number*	Facility: Quantity	Manhours: Horizontal Unit	Horizontal Net	Vertical Unit	Vertical Net	General Unit	General Net	Total
Tank w/8-inch line	10,000 bbl	41180 AK	19	161	3,059	978	18,582	495	9,405	31,046
Tank w/8-inch line	3,000 bbl	41180 AH	4	104	416	357	1,428	253	1,012	2,856
Tank, water, w/ 4-inch line	1,000 bbl	41180 AE	1	92	92	368	368	150	150	610
Tank, 250 bbl w/ 4-inch line	250 bbl	41180 AB	1	29	29	115	115	52	52	196
POL switching manifold	8-inch diameter	12510 AC	1	12	12	207	207	69	69	288
Pump station		12530 AK	2	6	12	40	80	23	46	138
Tank pump & manifold	1,400 BPH	12510 AJ	4	6	24	40	160	12	48	232
Transfer pump & manifold	1,400 BPH	12510 AP	1	40	40	282	282	58	58	380
Pipe & accessories grooved	1,000 ft, 8-inch diameter	12510 BK	6	12	72	230	1,380	161	966	2,418
Pipe & accessories tubing	1,000 ft, 8-inch diameter	12510 AV	1	12	12	127	127	69	69	208
Admin & Op building	20 x 40 ft	61050 DH	1	8	8	236	236	72	72	316
Fence	1,000 ft	87210 AR	5	55	275	255	1,275	258	1,290	2,840
Gate		87210 AT	2	9	18	138	276	55	110	404
TOTAL					4,069		24,516		13,347	41,932

*Facility data taken from TM 5-301.

Figure M-2

MANHOUR REQUIREMENTS FOR 300,000-GALLON FUELING SYSTEM

	Horizontal	Vertical	General	Total
Europe and NEA	216	164	384	764
SWA	248	189	442	879

Figure M-3

POUNDS PER GALLON OF POL*

AVGAS	5.90
JP4	6.42
MOGAS	6.11
Diesel	6.99
TOTAL	25.42
AVERAGE	6.36

*FM 101-10-1, Table 3-5.

Figure M-4

MANHOURS PER STON

Installation	Installation Manhours				Installation Capacity (STON)	Manhours Per STON			
	Europe & NEA		SWA			Europe & NEA		SWA	
	Skilled	Total	Skilled	Total		Skilled	Total	Skilled	Total
Bolted Tanks	25,120	36,821	28,585	41,932	26,712	0.9	1.4	1.1	1.6
Bladders	380	764	437	879	954	0.4	0.8	0.5	0.9
SUM						1.3	2.2	1.6	2.5
AVERAGE						0.7	1.1	0.8	1.3

Figure M-5

LAST PAGE OF TAB M

TAB N

TASK 14: PRISONER OF WAR (PW) CAMP CONSTRUCTION

AD-A162 599 ENGINEER WORKLOAD FACTORS (FASTALS (FORCE ANALYSIS SIMULATION OF THEATER. (U) ARMY ENGINEER STUDIES CENTER FORT BELVOIR VA B W SPRINGFIELD ET AL NOV 85 2/2

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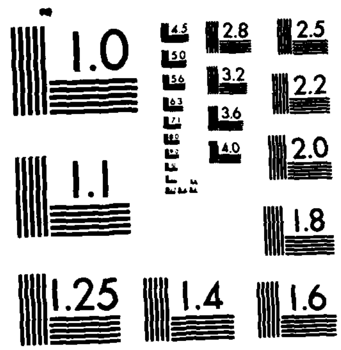

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TAB N

TASK 14: PRISONER OF WAR (PW) CAMP CONSTRUCTION

Engineer Workload Factors:

	Manhours/PW		
	Europe	NEA	SWA
Total Task:	35	44	50
Skilled Engineer Effort:	22	28	33

1. Standard of Construction: This installation is the most austere level available within the AFCS system. The classification is initial standard. Accommodations are in tents without frames and with earth floors. No engineer labor is allocated for erecting tents.

2. Method: PW camps are no longer included in the AFCS. The 5,000-man troop camp shown on Drawing NT 5011 is therefore adapted for the purpose. This camp is composed of four 1,000-man camps NT 1511 and four 250-man camps NT 1121. Each 1,000-man camp is composed of three 250-man camps NT 1121 and two 125-man camps NT 1021. In all, there are sixteen 250-man camps and eight 125-man camps.

a. Although this camp is not the exact size contemplated in United States Army, Europe (USAREUR) Operation Plan (OPLAN) 4102, the workload factor developed accurately reflects the per capita workload.[1]

b. The installation is modified by deleting motor pool and maintenance areas and their access roads, and by adding security fencing with guard towers and sentry boxes. Road mileage is reduced by eliminating duplication

[1]Department of the Army, United States Army, Europe and Seventh Army, Headquarters, CINCUSAREUR Operations Plan (OPLAN) 4102-83, Heidelberg, Federal Republic of Germany, October 1983 (SECRET).

where the 1,000-man camps adjoin. In the computation, half the duplication is deducted from each. Excessive driveways are also deleted from the 1,000-man and 5,000-man camps.

c. Double fencing consists of one Type W fence, which carries lights, and one Type Y fence which does not. Although the inside fence is a little shorter than the outer, the same length is used for both as the error in this gross estimate is not significant.

d. The manhours/PW factors are obtained by dividing total manhours (Figures N-17, N-18, and N-19) by 5,000.

3. Computation:

a. Requirements are computed separately for the 125-man, 250-man, 1,000-man, and 5,000-man installations. Requirements given for the larger camps do not include those of their subordinate elements. An exception is security fencing as this is shared by adjacent units in some cases.

b. Site preparation:

125-man camp--510 x 448 feet ÷ 43,560 = 5.2 acres
250-man camp--510 x 486 feet ÷ 43,560 = 5.7 acres
1,000-man camp--24.4 + 1.9 - (270 x 1,186 feet ÷ 43,560) = 19 acres
5,000-man camp--3.7 + 2.8 = 6.5 acres

c. Roads:

(1) A 20-foot wide road requirement for a 1,000-man camp: 1.3 miles--[(270 feet x 2) + (63 feet x 9) + (1,408 feet ÷ 2)] ÷ 5,280 = 1 mile.

The deduction represents roads in the motor pool area, excessive driveways, and half of the road shared with the adjoining camp.

(2) A 24-foot-wide road requirement for a 1,000-man camp: 0.32 miles--(270 feet ÷ 5,280) = 0.3 mile.

The deduction represents a road in the deleted motor pool area.

(3) Driveway requirement for a 5,000-man camp: 0.41 mile--(9 x 63 feet) ÷ 5,280 = 0.3 mile.

The deduction is for excessive driveways.

d. Road Surface: The perimeter road of the 1,000-man camp serves on three sides only as a patrol road. The surfacing is deleted from that specified for the AFCS installation for the patrol road, and for the nine 63-foot driveways which have been eliminated. The surfacing requirement is:

1.3 mile--[2 x (1,552 + 126 + 40 feet) + (970 + 126 + 40 feet) + (9 x 63 feet)] ÷ 5,280 = 0.3 mile

e. Fence:

(1) A 1,000-man camp. In each 1,000-man camp are two 125-man camps and three 250-man camps, each surrounded by double fence. However, the 125-man camps adjoin each other and a common double fence may be used between them. The requirement for a double perimeter fence for the 125-man camps is (510 feet x 3) + (448 feet x 4) = 3,322 feet. For the 250-man camps, it is (510 feet x 6) + (486 feet x 6) = 5,976 feet. Internally, the headquarters area is separated from the recreation area, and the living area is separated from both by single fence. This requires 234 + 610 feet = 844 feet for each 125-man camp and 243 + 610 feet = 859 feet for each 250-man camp; that is, 844 feet x 2 = 1,688 feet for both 125-man camps and 859 feet x 3 = 2,577 feet for all three 250-man camps. The 1,000-man headquarters area needs a single fence on three sides only, as it abuts the double fence of one of the 250-man camps on the fourth side. Headquarters requirement is 410 feet + (2 x 200 feet) = 810 feet of single fence. The entire 1,000-man camp is enclosed by a double fence inside the perimeter road. The requirement is 2 x (1,652 + 1,070 feet) = 5,444 feet of double fence. Fencing requirements of the 1,000-man camps are shown in Figure N-1.

(2) 5,000-man camp. Each pair of the four 250-man camps shares a common fence. The requirement for double perimeter fence is therefore:

(6 x 510 feet) + (8 x 486 feet) = 6,948 feet. Internal single fencing requires 4 x 859 feet = 3,436 feet. The camp headquarters area requires 2 x (502 + 240 feet) = 1,484 feet of single perimeter fence. To complete the double perimeter fence in the areas not already enclosed by the 1,000-man camp perimeter fences requires 2 x 694 feet = 1,388 feet of double fence. The complete 5,000-man camp fencing requirement is shown in Figure N-2.

RECAPITULATION--1,000-MAN CAMP FENCING (Feet)

	Single	Double	
	Type Y	Type X	Type W
125-man camps	1,688	3,322	3,322
250-man camps	2,577	5,976	5,976
1,000-man camps	810	5,444	5,444
TOTAL	5,075	14,742	14,742

Figure N-1

RECAPITULATION--COMPLETE 5,000-MAN PW CAMP FENCING (Feet)

	Single	Double	
	Type Y	Type X	Type W
Four 1,000-man camps (Figure N-1)	20,300	58,968	58,968
Four 250-man camps	3,436	6,948	6,948
Camp Headquarters	1,484	--	--
Completion of perimeter	--	1,388	1,388
TOTAL	25,220	67,304	67,304

Figure N-2

f. Gates: In the 125-man and 250-man camps, both vehicle and personnel gates are required in the double fences at the camp entrances and to provide access to the confinement areas. A vehicle gate and personnel gate permit access to the recreation area from the headquarters area. A personnel gate makes the recreation area accessible from the confinement area. In the 1,000-man camp, vehicle and personnel gates are needed in the double fence at the entrance and at the entrance to the headquarters area. The 5,000-man camp requires both types of gate at the double-fenced camp entrance and at the camp headquarters entrance. Gate requirements are developed in Figure N-3.

GATE REQUIREMENTS

Camp		Vehicle Gates		Personnel Gates	
Type	Number	Per Camp	Total	Per Camp	Total
125-man	8	4	32	5	40
250-man	16	4	64	5	80
1,000-man	4	3	12	3	12
5,000-man	1	3	3	3	3
TOTAL			111		135

Figure N-3

g. Sentry Box: A sentry box is required at each camp entrance and at the entrance to each 125-man and 250-man camp confinement compound, as well as the 1,000-man and 5,000-man headquarters compounds. Sentry box requirements are developed in Figure N-4.

SENTRY BOX REQUIREMENTS

Camp		Sentry Boxes	
Type	Number	Per Camp	Total
125-man	8	2	16
250-man	16	2	32
1,000-man	4	2	8
5,000-man	1	2	2
TOTAL			58

Figure N-4

h. Manhours: Manhour requirements for construction are developed in Figures N-5 through N-19, as shown below:

	Europe	NEA	SWA
125-man camp	N-5	N-6	N-7
250-man camp	N-8	N-9	N-10
1,000-man camp	N-11	N-12	N-13
5,000-man camp	N-14	N-15	N-16
Complete 5,000-man camp	N-17	N-18	N-19

i. Manhours/PW: The manhour requirements developed in Figures N-16, N-17, and N-18 are divided by 5,000 to derive the factors for manhours/PW as shown below:

Total Task:

Skilled Engineer Effort:

Europe Manhours/PW	NEA Manhours/PW	SWA Manhours/PW
35	44	50
22	48	33

MANHOURS FOR 125-MAN TROOP CAMP MODIFIED AS PW CAMP--EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.2	88	458	0	0	32	166	624
Road	mile	85130 FD	0.02	2,265	45	0	0	905	18	63
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 AY	0.3	215	65	0	0	77	23	88
TOTAL					594		200		520	1,314

*Facility data as shown in TM 5-301, run 850117.

Figure N-5

MANHOURS FOR 125-MAN TROOP CAMP MODIFIED AS PW CAMP--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.2	88	458	0	0	32	166	624
Road	mile	85130 FW	0.02	6,850	137	0	0	2,719	54	191
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 BR	0.3	594	178	0	0	184	55	233
TOTAL					799		200		588	1,587

*Facility data as shown in TM 5-301, run 850117.

Figure N-6

MANHOURS FOR 125-MAN TROOP CAMP MODIFIED AS PW CAMP--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	13	26	115	230	179	358	614
Site Preparation	acre	87190 AA	5.2	101	525	0	0	37	192	717
Road	mile	85130 FW	0.02	7,878	158	0	0	3,127	63	221
Road Surface	mile	85110 BM	0.02	217	4	0	0	74	1	5
Hardstand	1,000 SY	85210 BR	0.3	683	205	0	0	212	64	269
TOTAL					918		230		678	1,826

*Facility data as shown in TM 5-301, run 850117.

Figure N-7

MANHOURS FOR 250-MAN TROOP CAMP MODIFIED AS PW CAMP--EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.7	88	528	0	0	32	192	720
Road	mile	85130 FD	0.02	2,265	45	0	0	905	18	63
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 AY	0.3	215	65	0	0	77	23	88
TOTAL					664		200		546	1,410

*Facility data as shown in TM 5-301, run 850117.

Figure N-8

MANHOURS FOR 250-MAN TROOP CAMP MODIFIED AS PW CAMP--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.7	88	502	0	0	32	182	684
Road	mile	85130 FW	0.02	6,850	137	0	0	2,719	54	191
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 BR	0.3	594	178	0	0	184	55	233
TOTAL					843		200		604	1,647

*Facility data as shown in TM 5-301, run 850117.

Figure N-9

MANHOURS FOR 250-MAN TROOP CAMP MODIFIED AS PW CAMP--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	13	26	115	230	179	358	614
Site Preparation	acre	87190 AA	5.7	101	576	0	0	37	211	787
Road	mile	85130 FW	0.02	7,878	158	0	0	3,127	63	221
Road Surface	mile	85110 BM	0.02	217	4	0	0	74	1	5
Hardstand	1,000 SY	85210 BR	0.3	683	205	0	0	212	64	269
TOTAL					969		230		697	1,896

*Facility data as shown in TM 5-301, run 850117.

Figure N-10

1,000-MAN TROOP CAMP MODIFIED AS PW CAMP--EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road, 20 ft	mile	85130 FD	1	2,265	2,265	0	0	905	905	3,170
Road Surface, 20 ft	mile	85110 BM	.3	189	57	0	0	64	19	76
Road, 24 ft	mile	85130 AY	.27	2,500	675	0	0	1,005	271	946
Road Surface, 24 ft	mile	85110 AR	.27	210	57	0	0	72	19	76
Site Preparation	acre	87190 AA	19	88	1,672	0	0	32	608	2,280
Hardstand	1,000 SY	85210 AY	.93	215	200	0	0	77	72	272
Hardstand Surface	1,000 SY	85110 DF	.93	24	22	0	0	8	7	29
TOTAL					4,948		0		1,901	6,849

*Facility data as shown in TM 5-301, run 850117.

Figure N-11

1,000-MAN TROOP CAMP MODIFIED AS PW CAMP--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road, 20 ft	mile	85130 FW	1	6,850	6,850	0	0	2,719	2,719	9,569
Road Surface, 20 ft	mile	85110 BM	0.3	189	57	0	0	64	19	76
Road, 24 ft	mile	85130 BR	0.27	7,622	2,058	0	0	3,019	815	2,873
Road Surface, 24 ft	mile	85110 AR	0.27	210	57	0	0	72	19	76
Site Preparation	acre	87190 AA	19	88	1,672	0	0	32	608	2,280
Hardstand	1,000 SY	85210 BR	0.93	594	552	0	0	184	171	723
Hardstand Surface	1,000 SY	85110 DF	0.93	24	22	0	0	8	7	29
TOTAL					11,268		0		4,358	15,626

*Facility data as shown in TM 5-301, run 850117.

Figure N-12

1,000-MAN TROOP CAMP MODIFIED AS PW CAMP--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road, 20 ft	mile	85130 FW	1	7,878	7,878	0	0	3,127	3,127	11,005
Road Surface, 20 ft	mile	85110 BM	0.3	217	65	0	0	74	22	87
Road, 24 ft	mile	85130 BR	0.27	8,765	2,367	0	0	3,472	937	3,304
Road Surface, 24 ft	mile	85110 AR	0.27	242	65	0	0	83	22	87
Site Preparation	acre	87190 AA	19	101	1,919	0	0	37	703	2,622
Hardstand	1,000 SY	85210 BR	0.93	683	635	0	0	212	197	832
Hardstand Surface	1,000 SY	85110 DF	0.93	28	26	0	0	9	8	34
TOTAL					12,955		0		5,016	17,971

*Facility data as shown in TM 5-301, run 850117.

Figure N-13

5,000-MAN TROOP CAMP MODIFIED AS PW CAMP--EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road	mile	85130 FD	0.3	2,265	680	0	0	905	272	952
Road Surface	mile	85110 BM	0.3	189	57	0	0	64	19	76
Site Preparation	acre	87190 AA	3.7	88	326	0	0	32	118	444
HQ Road	mile	85130 FD	0.095	2,265	215	0	0	905	86	301
HQ Road Surface	mile	85110 BM	0.095	189	18	0	0	64	6	24
HQ Hardstand	1,000 SY	85210 AY	1.38	215	297	0	0	77	106	403
HQ Hardstand Surface	1,000 SY	85110 DF	1.38	24	33	0	0	8	11	44
HQ Site Preparation	acre	87190 AA	2.8	88	246	0	0	32	90	336
TOTAL					1,872		0		708	2,580

*Facility data as shown in TM 5-301, run 850117.

Figure N-14

5,000-MAN TROOP CAMP MODIFIED AS PW CAMP--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road	mile	85130 FW	0.3	6,850	2,055	0	0	2,719	816	2,871
Road Surface	mile	85110 BM	0.3	189	57	0	0	64	19	76
Site Preparation	acre	87190 AA	3.7	88	326	0	0	32	118	444
HQ Road	mile	85130 FW	0.095	6,850	651	0	0	2,719	258	909
HQ Road Surface	mile	85110 BM	0.095	189	18	0	0	64	6	24
HQ Hardstand	1,000 SY	85210 BR	1.38	594	820	0	0	184	254	1,074
HQ Hardstand Surface	1,000 SY	85110 DF	1.38	24	33	0	0	8	11	44
HQ Site Preparation	acre	87190 AA	2.8	88	246	0	0	32	90	336
TOTAL					4,206		0		1,572	5,778

*Facility data as shown in TM 5-301, run 850117.

Figure N-15

ɔ,000-MAN TROOP CAMP MODIFIED AS PW CAMP--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Road	mile	85130 FW	0.3	7,878	2,363	0	0	3,127	938	3,301
Road Surface	mile	85110 BM	0.3	217	65	0	0	74	22	87
Site Preparation	acre	87190 AA	3.7	101	374	-	-	37	137	511
HQ Road	mile	85130 FW	0.095	7,878	748	0	0	3,127	297	1,045
HQ Road Surface	mile	85110 BM	0.095	217	21	0	0	74	7	28
HQ Hardstand	1,000 SY	85210 BR	1.38	683	943	-	-	212	293	1,236
HQ Hardstand Surface	1,000 SY	85110 DF	1.38	28	39	0	0	9	12	51
HQ Site Preparation	acre	87190 AA	2.8	101	283	0	0	37	104	387
TOTAL					4,836		0		1,810	6,646

*Facility data as shown in TM 5-301, run 850117.

Figure N-16

5,000-MAN CAMP COMPLETE—EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
125-Man Camp (Figure N-5)		NT 1021	8	594	4,752	200	1,600	520	4,160	10,512
250-Man Camp (Figure N-8)		NT 1121	16	664	10,624	200	3,200	546	8,736	22,560
1,000-Man Camp (Figure N-11)		NT 1511	4	4,948	19,792	0	0	1,901	7,604	27,396
5,000-Man Camp (Figure N-14)		NT 5011	1	1,872	1,872	0	0	708	708	2,580
Fence Type X (Figure N-2)	1,000 ft	87210 AP	67.3	46	3,096	254	17,094	256	17,229	37,419
Fence Type W (Figure N-2)	1,000 ft	87210 AN	67.3	46	3,096	472	31,766	256	17,229	52,091
Fence Type Y (Figure N-2)	1,000 ft	87210 AR	25.2	48	1,210	222	5,594	224	5,645	12,449
Vehicle Gate	12 ft	87210 AM	111	7	777	10	1,110	12	1,332	3,219
Personnel Gate	3 ft	87210 AH	135	7	945	10	1,350	4	540	2,835
Sentry Box	4 x 4 ft	87230 AA	58	1	58	4	232	2	116	406
Guard Tower	11 x 11 ft	87220 AA	28	7	196	72	2,016	44	1,232	3,444
TOTAL					46,418		63,962		64,531	175,721

*Facility data as shown in FM 5-301, Run 850117.

Figure N-17

5,000-MAN CAMP COMPLETE--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
125-Man Camp (Figure N-6)		NT 1021	8	799	6,392	200	1,600	588	4,704	12,696
250-Man Camp (Figure N-9)		NT 1121	16	843	13,488	200	3,200	604	9,664	26,352
1,000-Man Camp (Figure N-12)		NT 1511	4	11,268	45,072	0	0	4,358	17,432	62,504
5,000-Man Camp (Figure N-15)		NT 5011	1	4,206	4,206	0	0	1,572	1,572	5,778
Fence Type X (Figure N-2)	1,000 ft	87210 AP	67.3	46	3,096	254	17,094	256	17,229	37,419
Fence Type W (Figure N-2)	1,000 ft	87210 AN	67.3	46	3,096	472	31,766	256	17,229	52,091
Fence Type Y (Figure N-2)	1,000 ft	87210 AR	25.2	48	1,210	222	5,594	224	5,645	12,449
Vehicle Gate	12 ft	87210 AM	111	7	777	10	1,110	12	1,332	3,219
Personnel Gate	3 ft	87210 AH	135	7	945	10	1,350	4	540	2,835
Sentry Box	4 x 4 ft	87230 AA	58	1	58	4	232	2	116	406
Guard Tower	11 x 11 ft	87220 AA	28	7	196	72	2,016	44	1,232	3,444
TOTAL					78,536		63,962		76,695	219,193

*Facility data as shown in TM 5-301, run 850117.

Figure N-18

5,000-MAN CAMP COMPLETE--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
125-Man Camp (Figure N-7)		NT 1021	8	918	7,344	230	1,840	678	5,424	14,608
250-Man Camp (Figure N-10)		NT 1121	16	969	15,504	230	3,680	697	11,152	30,336
1,000-Man Camp (Figure N-13)		NT 1511	4	12,955	51,820	0	0	5,016	20,064	71,884
5,000-Man Camp (Figure N-16)		NT 5011	1	4,836	4,836	0	0	1,810	1,810	6,646
Fence Type X (Figure N-2)	1,000 ft	87210 AP	67.3	52	3,567	292	19,651	294	19,786	43,004
Fence Type W (Figure N-2)	1,000 ft	87210 AN	67.3	53	3,567	543	36,544	294	19,786	59,897
Fence Type Y (Figure N-2)	1,000 ft	87210 AR	25.2	55	1,386	255	6,426	258	6,502	14,314
Vehicle Gate	12 ft	87210 AM	111	8	888	12	1,332	14	1,554	3,774
Personnel Gate	3 ft	87210 AH	135	8	1,080	12	1,620	5	675	3,375
Sentry Box	4 x 4 ft	87230 AA	58	1	58	5	290	2	116	464
Guard Tower	11 x 11 ft	87220 AA	28	8	224	83	2,324	51	1,428	3,976
TOTAL					90,274		73,707		88,297	252,278

*Facility data as shown in TM 5-301, run 850117.

Figure N-19

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TAB O

TASK 15: MILITARY STOCKADE CONSTRUCTION

TAB O

TASK 15: MILITARY STOCKADE CONSTRUCTION

Engineer Workload Factors:

	Manhours Per Man in Theater		
	Europe	NEA	SWA
Total Task:	0.10	0.10	0.12
Skilled Labor Only:	0.06	0.06	0.07

1. Standard of Construction: This installation is the most austere level available within the AFCS system. It is classified as an initial standard. Accommodations are in tents without frames and with earth floors. No engineer labor is allocated for erecting tents.

2. Method:

a. As stockades for the confinement of military personnel are not normally built in the combat zone, stockades in the COMMZ will be needed for offenders from forward areas, as well as those assigned to COMMZ. The factor used in this analysis, manhours/man in theater, is therefore more realistic than the factor manhours/man in COMMZ previously used.

b. A stockade installation is no longer in the AFCS. The 250-man troop camp, AFCS Installation NT 1121, is therefore modified to serve as a substitute. Modifications consist of deleting the motor pool and maintenance area and its access road, and adding security facilities. These are a double fence around the perimeter, single fence to separate the administrative area from the recreation area and the confinement area from both, guard towers, and sentry boxes.

3. Computation: In a non-nuclear situation, 1 percent of the command is expected to be confined, and of that number, 45 percent are retained in

stockades in the theater.[1] Thus, 0.45 percent of the command are confined in stockades.

a. Deletion of the motor maintenance and parking areas reduces the long dimension of the camp by 92 feet; 602 - 92 = 510 feet. The short dimension remains 486 feet.

$$\text{Area in acres} = (486 \times 510 \text{ feet}) \div 43{,}560 = 5.7 \text{ acres}$$

The perimeter is 2 x (510 + 486 feet) = 1,992 feet. For the double fence, 1,992 feet of Type X and 1,992 feet of Type W are required.

b. To separate the confinement area from the administrative and the recreation areas, 610 feet of single fence Type Y are required. An additional 243 feet is needed to separate the administrative area from the recreation area: 610 + 243 = 853 feet of Type Y fence.

c. Vehicle and personnel gates are needed in the double fence at the entrance, and in the single fences separating the administrative area from the confinement area and from the recreation area. A personnel gate is needed in the single fence separating the confinement area from the recreation area. The total requirement is four vehicle gates and five personnel gates.

d. Sentry boxes are required at the camp entrance and at the gate giving access to the confinement area.

e. Manhour requirements are developed in Figure O-1 for Europe, Figure O-2 for NEA, and Figure O-3 for SWA. Manhours per person confined are determined by dividing the totals of Figures O-1, O-2, and O-3 by 250. Manhours per man in theater are determined by multiplying manhours per man confined by the percentage of the command confined. These computations are shown in Figure O-4.

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[1] FM 101-10-1, paragraph 5-8.

250-MAN TROOP CAMP MODIFIED AS MILITARY STOCKADE—EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

	Facility			Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number[a]	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.7	88	502	0	0	32	182	684
Road	mile	85130 FD	0.02	2,265	45	0	0	905	18	63
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 AY	0.3	215	65	0	0	77	23	88
Fence Type Y	1,000 ft	87210 AR	0.85	48	41	222	189	224	190	420
Fence Type X	1,000 ft	87210 AP	2	46	92	254	508	256	512	1,112
Fence Type W	1,000 ft	87210 AN	2	46	92	472	944	256	512	1,548
Personnel Gate	3 ft	87210 AH	5	7	35	10	50	4	20	105
Vehicle Gate	12 ft	87210 AM	4	7	28	10	40	12	48	116
Guard Tower	11 x 11 ft	87220 AA	6	7	42	72	432	44	264	738
Sentry Box	4 x 4 ft	87230 AA	2	1	2	4	8	2	4	14
TOTAL					970		2,371		2,086	5,427

[a]Facility data as shown in FM 5-301, run 850117

Figure O-1

250-MAN TROOP CAMP MODIFIED AS MILITARY STOCKADE—NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	11	22	100	200	156	312	534
Site Preparation	acre	87190 AA	5.7	88	502	0	0	32	182	684
Road	mile	85130 FW	0.02	6,850	137	0	0	2,719	54	191
Road Surface	mile	85110 BM	0.02	189	4	0	0	64	1	5
Hardstand	1,000 SY	85210 BR	0.3	594	178	0	0	184	55	233
Fence Type Y	1,000 ft	87210 AR	0.85	48	41	222	189	224	190	420
Fence Type X	1,000 ft	87210 AP	2	46	92	254	508	256	512	1,112
Fence Type W	1,000 ft	87210 AN	2	46	92	472	944	256	512	1,548
Personnel Gate	3 ft	87210 AH	5	7	35	10	50	4	20	105
Vehicle Gate	12 ft	87210 AM	4	7	28	10	40	12	48	116
Guard Tower	11 x 11 ft	87220 AA	6	7	42	72	432	44	264	738
Sentry Box	4 x 4 ft	87230 AA	2	1	2	4	8	2	4	14
TOTAL					1,175		2,371		2,154	5,700

Figure 0-2

250-MAN TROOP CAMP MODIFIED AS MILITARY STOCKADE--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190 AA	2	13	26	115	230	179	358	614
Site Preparation	acre	87190 AA	5.7	101	576	0	0	37	211	787
Road	mile	85130 FW	0.02	7,878	158	0	0	3,127	63	221
Road Surface	mile	85110 BM	0.02	217	4	0	0	74	1	5
Hardstand	1,000 SY	85210 BR	0.3	683	205	0	0	212	64	269
Fence Type Y	1,000 ft	87210 AR	0.85	55	47	255	218	258	219	484
Fence Type X	1,000 ft	87210 AP	2	53	106	292	584	294	588	1,278
Fence Type W	1,000 ft	87210 AN	2	53	106	543	1,086	294	588	1,780
Personnel Gate	3 ft	87210 AH	5	8	40	12	60	5	25	125
Vehicle Gate	12 ft	87210 AM	4	8	32	12	48	14	56	136
Guard Tower	11 x 11 ft	87220 AA	6	8	48	83	498	51	306	852
Sentry Box	4 x 4 ft	87230 AA	2	1	2	5	10	2	4	16
TOTAL					1,350		2,734		2,483	6,567

Figure O-3

MANHOURS PER MAN IN THEATER

	Camp Population	Manhours			Manhours/ Man Confined			Percent of Command Confined	Manhours/ Man in Theater		
		Europe	NEA	SWA	Europe	NEA	SWA		Europe	NEA	SWA
Total Task	250	5,427	5,700	6,567	21.7	22.8	26.3	0.45	0.10	0.10	0.12
Skilled Engineer Effort	250	3,341	3,546	4,084	13.4	14.2	16.3	0.45	0.06	0.06	0.07

Figure 0-4

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TAB P

TASK 16: HOSPITALS

TAB P

TASK NO. 16: HOSPITALS

Engineer Workload Factors:

a. Factor I: Renovations Without Use of DMS (Europe and NEA):

Total Task:	22.2 Manhours/Bed
Skilled Engineer Effort:	20.4 Manhours/Bed

b. Factor II: Renovations With Use of DMS (Europe and NEA):

Total Task:	8.6 Manhours/Bed
Skilled Engineer Effort:	8.0 Manhours/Bed

c. Factor III: Field Location Without Use of DMS (Europe and NEA):

Total Task:	114.4 Manhours/Bed
Skilled Engineer Effort:	100.2 Manhours/Bed

d. Factor IV: Field Location With Use of DMS (Europe and NEA):

Total Task:	61.4 Manhours/Bed
Skilled Engineer Effort:	52.2 Manhours/Bed

e. Factor V: Renovations Without Use of DMS (SWA):

Total Task:	25.5 Manhours/Bed
Skilled Engineer Effort:	23.5 Manhours/Bed

f. Factor VI: Renovations With Use of DMS (SWA):

Total Task:	9.9 Manhours/Bed
Skilled Engineer Effort:	9.0 Manhours/Bed

g. Factor VII: Field Location Without Use of DMS (SWA):

Total Task:	130.9 Manhours/Bed
Skilled Engineer Effort	114.5 Manhours/Bed

h. Factor VIII: Field Location With Use of DMS (SWA):

Total Task:	64.3 Manhours/Bed
Skilled Engineer Effort:	54.5 Manhours/Bed

1. Europe and NEA:

a. Standard of construction: Renovations of buildings of opportunity to austere standards for end use as a General Hospital, or a General Hospital constructed without buildings of opportunity in a field or wooded area, also to austere standards.

b. Method for renovations: The basis is the 1,000-bed general hospital. Workload estimates were generated using the detailed engineering analysis under development at the US Army Engineer Division, Europe, in support of the "warm base" general hospital located in the Beitel complex, Netherlands. Assumptions were made in generating these factors regarding the ability to locate appropriate buildings of opportunity for hospital use, and in addition, that utility services (i.e., water, sewer, power, and heat) were all available in required quantities and these systems were in operating condition.

(1) Factor I--Renovations Without Use of DMS. This engineer workload estimate is based on all hospital functions being located in buildings of opportunity. The factor is appropriate for use where deployed general hospital units will not have DMS available. Figure P-1 provides a breakdown of the workload items considered in Factor I.

(2) Factor II--Renovations With Use of DMS. This engineer workload estimate is based on the hospital core requirements (surgery, radiology, laboratory, pharmacy, intensive care, and central material supply) all functioning within individual ISO shelters. A total of 13 ISO shelters plus two configured TEMPER tents would be employed, and all other hospital functions would be located in buildings of opportunity. The factor is appropriate for use where the general hospital unit will be utilizing DMS. Figure P-2 provides a breakdown of the workload items considered in Factor II. Current DA

programming indicates that fielding of DMS with its compatible systems will be completed for all general hospital units by FY 91.

FACTOR I: WORKLOAD ESTIMATE FOR A 1,000-BED GENERAL HOSPITAL (EUROPE/NEA)
(Renovations Without Use of DMS)

Item	Labor in Manhours
Utilities distribution and modifications	14,800
Partitions, openings, and ceilings	3,000
General cleaning and selective painting	1,000
Heating system modifications	800
Air Conditioning for surgery and ICU	1,000
Ramps (mobile)	100
Vaults (pharmacy, arms)	200
New flooring in selective areas	200
Flammable and gas storage	400
Helipad	200
Fence and lighting	500
Total	22,200

Figure P-1

FACTOR II: WORKLOAD ESTIMATE FOR A 1,000-BED GENERAL HOSPITAL (EUROPE/NEA)
(Renovations With Use of DMS)

Item	Labor in Manhours
Utilities distribution and modifications	3,600
Partitions, openings, and ceilings	1,500
General cleaning and selective painting	1,000
Heating system modifications	400
Ramps (mobile)	100
New flooring in selective areas	100
Flammable and gas storage	400
Grading, footings, and paving	500
Walkways, overhead cover (buildings to ISOs)	300
Helipad	200
Fence and lighting	500
Total	8,600

Figure P-2

c. Method for field location: The basis is again the 1,000-bed general hospital, AFCS Installation GH 1021. This installation, classified as an initial standard, is the most austere in the AFCS.

(1) Factor III--Field Location Without Use of DMS. This engineer workload estimate is based on administrative housing, and non-medical hospital functions being sheltered in unframed tents. Tentage with frames is used for wards and for other medical functions that can tolerate such housing. Ten percent of the tentage with frames are dedicated to Intensive Care Units. Wood-framed buildings are used for all remaining facilities, which are required to service the hospital wards. One building (Utility Building #3) provides bathing, lavatory, treatment, and medical storage support to six adjoining ward tents. Figure P-3 provides a breakdown of the manhour requirements considered in Factor III.

(2) Factor IV--Field Location With Use of DMS. This engineer workload estimate is based on administrative, housing, and non-medical functions being sheltered in unframed general purpose tents. The Tent Extendable Modular Personnel (TEMPER), will be used for wards and for other medical functions that requires such shelter. Intensive Care Units would be housed with the use of DMS/ISO shelters. The hospital core requirements such as surgery, radiology, laboratory, pharmacy, intensive care, and central material supply would function within individual ISO shelters. All remaining hospital functions would be located in wood-framed buildings. All water storage and water and electrical distribution requirements would be met using DMS compatible systems (i.e., the Water Storage and Distribution Set, and the Distribution Illumination System Electrical (DISE)). DMS components and field utility systems reduce the engineer construction effort associated with the ward support

FACTOR III: MANHOUR REQUIREMENTS FOR 1,000-BED HOSPITAL CONSTRUCTION (EUROPE/NEA)—FIELD LOCATION WITHOUT USE OF DMS
(Temperate Climate)

Facility				Manhours						
		AFCS		Horizontal		Vertical		General		
Item	Size or Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Tentage w/frames	16 x 32 ft	72520 AC	117	2	234	8	936	6	702	1,872
Buildings										
Centralized Materiel	40 x 120 ft	51010 LU	1	77	77	5,567	5,567	308	308	5,952
EENT and Pharmacy	30 x 70 ft	51010 KT	1	56	56	2,407	2,407	163	163	2,626
Laboratory & Dental	40 x 120 ft	53020 CV	1	77	77	4,648	4,648	366	366	5,091
Latrine	10 x 20 ft	72321 BD	6	2	12	200	1,200	32	192	1,404
Surgery	40 x 150 ft	51010 LH	1	90	90	7,188	7,188	451	451	7,729
Utility #3	30 x 60 ft	51010 MJ	15	46	690	2,986	44,790	141	2,115	47,595
Utility #9	30 x 50 ft	51010 MP	1	48	48	2,502	2,502	119	119	2,669
X-Ray	40 x 90 ft	53020 CF	1	76	76	3,657	3,657	279	279	4,012
Hardstand	1,000 SY	85210 BF	18.8	327	6,147.6	0	0	118	2,218.4	8,366
Road	mile	85130 FK	1.2	3,347	4,016.4	0	0	1,477	1,772.4	5,788.8
Sump, Fire	10,000 gal	84330 AC	6	16	96	108	648	116	696	1,440
Water Tank	21,000 gal	84120 AE	1	0	0	420	420	0	0	420
Site Preparation	acre	87190 AA	38.9	88	3,423.2	0	0	32	1,244.8	4,668
Water Distribution	50,000 GPD	84210 DC	1	764	764	1,656	1,656	755	755	3,175
Sewage	25,000 GPD	83111 AY	1	577	577	1,420	1,420	1,060	1,060	3,057
Electric Distribution	139.7 KW	81240 BG	1	590	590	6,205	6,205	1,750	1,750	8,545
Total					16,974.2		83,244		14,191.6	114,409.8

Figure P-3

building (Utility Building #3) by approximately 40 percent. AFCS work estimates for that facility have been adjusted and Figure P-4 provides a breakdown of the manhour requirements considered in Factor IV.

2. SWA:

a. Standard of construction: Renovations of buildings of opportunity to austere standards for end use as a General Hospital, or a General Hospital constructed without buildings of opportunity in a field or wooded area, also to austere standards.

b. Method for renovations: The basis is the 1,000-bed General Hospital. Workload estimates were modified from the Europe/NEA computations. Assumptions were again made in generating these factors regarding the ability to locate appropriate buildings of opportunity for hospital use, and in addition, that utility services (i.e., water, sewer, power, and heat) were all available in required quantities and these systems were in operating condition. Since the Europe/NEA engineer effort computations were for a Temperate Climate, they are mutiplied by a factor of 1.15 to arrive at an estimate of Desert Climate engineer effort.

(1) Factor V--Renovations Without Use of DMS. This engineer workload estimate, like the Europe/NEA estimate, is based on all housing functions being located in buildings of opportunity. Since the Europe/NEA engineer effort computations were for a Temperate Climate, they are multiplied by a factor of 1.15 to arrive at an estimate of Desert Climate engineer effort. This factor is also appropriate for use where deployed general hospital units will not have DMS available. Figure P-5 provides a breakdown of the workload items considered in Factor V.

(2) Factor VI--Renovations With Use of DMS. This engineer workload estimate, also like the Europe/NEA estimate is based on the core

FACTOR IV: MANHOUR REQUIREMENTS FOR 1,000-BED HOSPITAL CONSTRUCTION (EUROPE/NEA)—FIELD LOCATION WITH USE OF DMS
(Desert Climate)

Facility				Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Buildings:										
Latrine	10 x 20 ft	72321 BD	6	2	12	200	1,200	32	192	1,404
Utility #3	30 x 60 ft	51010 MJ	15	27.6	414	1,791.6	26,874	84.6	1,269	28,557
Utility #9	30 x 50 ft	51010 MP	1	48	48	2,502	2,502	119	119	2,669
Hardstand	1,000 SY	85210 BF	18.8	327	6,147.6	0	0	118	2,218.4	8,366
Road	mile	85130 FK	1.2	3,347	4,016.4	0	0	1,477	1,772.4	5,788.8
Sump, Fire	10,000 gal	84330 AC	6	16	96	108	648	116	696	1,440
Site Preparation	acre	87190 AA	38.9	88	3,423.2	0	0	32	1,244.8	4,668
Sewage	25,000 GPD	83111 AY	1	590	590	6,205	6,205	1,750	1,750	8,545
Total					14,747.2		37,429		9,261.6	61,437.8

Figure P-4

requirements (i.e., surgery, radiology, laboratory, pharmacy, intensive care, and central material supply) all functioning within individual ISO shelters, or TEMPER tents. All other hospital functions would be located in buildings of opportunity. The computations for a Temperate Climate were again multiplied by a factor of 1.15 to arrive at an estimate of Desert Climate engineer effort. The factor is appropriate for use where the general hospital unit will be utilizing DMS. Figure P-6 provides a breakdown of the workload items considered in Factor VI.

FACTOR V: WORKLOAD ESTIMATE FOR A 1,000-BED GENERAL HOSPITAL (SWA)
(Renovations Without Use of DMS)

Item	Labor in Manhours
Utilities distribution and modifications	17,020
Partitions, openings, and ceilings	3,450
General cleaning and selective painting	1,150
Heating system modifications	920
Air Conditioning for su.gery and ICU	1,150
Ramps (mobile)	115
Vaults (pharmacy, arms)	230
New flooring in selective areas	230
Flammable and gas storage	460
Helipad	230
Fence and lighting	575
Total	25,530

Figure P-5

c. Method for field location: As stated previously, the basis is the 1,000-bed general hospital, AFCS Installation GH 1021. As the buildings and utilities are not listed in TM 5-301 for Desert Climate, construction manhours for Temperate Climate are multiplied by a factor of 1.15 to arrive at a estimate of Desert Climate engineer effort.

FACTOR VI: WORKLOAD ESTIMATE FOR A 1,000-BED GENERAL HOSPITAL (SWA)
(Renovations With Use of DMS)

Item	Labor in Manhours
Utilities distribution and modifications	4,140
Partitions, openings, and ceilings	1,725
General cleaning and selective painting	1,150
Heating system modifications	460
Ramps (mobile)	115
New flooring in selective areas	115
Flammable and gas storage	460
Grading, footings, and paving	575
Walkways, overhead cover (buildings to ISOs)	345
Helipad	230
Fence and lighting	575
Total	9,890

Figure P-6

(1) Factor VII--Field Location Without Use of DMS. This engineer workload estimate, also like the Europe/NEA estimate is based on administrative, housing, and non-medical hospital functions being sheltered in unframed tents. Tentage with frames is used for wards and for other medical functions that can tolerate such housing. Ten percent of the tentage with frames are dedicated to Intensive Care Units. Wood-framed buildings are used for all remaining facilities, which are required to service the hospital wards. Like the Europe/NEA estimate, one building provides bathing, lavatory, treatment, and medical storage support to 6 adjoining ward tents. Figure P-7 provides a breakdown of the workload manhour requirements considered in Factor VII.

(2) Factor VIII--Field Location With Use of DMS. This engineer workload estimate is also based on administrative, housing, and non-medical hospital functions being sheltered in unframed general purpose tents. Also

FACTOR VII: MANHOUR REQUIREMENTS FOR 1,000-BED HOSPITAL CONSTRUCTION (SWA)—FIELD LOCATION WITHOUT USE OF DMS
(Desert Climate)

Facility				Manhours						
		AFCS		Horizontal		Vertical		General		
Item	Size or Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Tentage w/frames	16 x 32 ft	72520 AC	117	2	234	9	1,053	7	819	2,106
Buildings										
Centralized Materiel	40 x 120 ft	51010 LU	1	89	89	5,730	5,730	421	421	6,240
EENT and Pharmacy	30 x 70 ft	51010 KT	1	64	64	2,768	2,768	188	188	3,020
Laboratory & Dental	40 x 120 ft	53020 CV	1	89	89	5,345	5,345	421	421	5,855
Latrine	10 x 20 ft	72321 BD	6	2	12	230	1,380	37	222	1,614
Surgery	40 x 150 ft	51010 LH	1	103	103	8,266	8,266	519	519	8,888
Utility #3	30 x 60 ft	51010 MJ	15	53	795	3,434	51,510	162	2,430	54,735
Utility #9	30 x 50 ft	51010 MP	1	55	55	2,877	2,877	137	137	3,069
X-ray	40 x 90 ft	53020 CF	1	87	87	4,206	4,206	321	321	4,614
Hardstand	1,000 SY	85210 BF	18.8	376	7,068.86	0	0	136	2,556.8	9,625.6
Road	mile	85130 FK	1.2	3,849	4,618.8	0	0	1,699	2,038.8	6,657.6
Sump, Fire	10,000 gal	84330 AC	6	18	108	124	744	133	798	1,650
Water Tank	21,000 gal	84120 AE	1	0	0	483	483	0	0	483
Site Preparation	acre	87190 AA	38.9	101	3,929	0	0	37	1,439	5,368
Water Distribution	50,000 GPD	84210 DC	1	879	879	1,904	1,904	868	868	3,651
Sewage	25,000 GPD	83111 AY	1	664	664	1,633	1,633	1,219	1,219	3,516
Electric Distribution	139.7 KW	81240 BG	1	679	679	7,136	7,136	2,012	2,012	9,827
Total					19,474.6		95,035		16,409.6	130,919.2

Figure P-7

like the Europe/NEA estimate, the TEMPER tent will be used for wards and for other medical functions that can tolerate such housing. The hospital core requirements will again function within individual ISO shelters. All remaining hospital functions would be located in wood-framed buildings. All water storage and water and electrical distribution requirements will again be met using the DMS compatible systems. DMS components and field utility systems again reduce the engineer construction effort associated with the ward support building (Utility Building #3) by approximately 40 percent. AFCS work estimates for that facility have been adjusted and Figure P-8 provides a breakdown of the workload manhour requirements considered in Factor IV.

3. Current Planning Strategy:

a. In order to meet requirements of the yearly Total Army Analysis (TAA), the Assistant Chief of Engineers's Office (ACE), and the Surgeon General's Office, have jointly agreed on theater specific hospital workload percentages. These percentages represent judgments at this point in time, and are not based on analyses. These figures represent the approximate percentage of time that either renovations or field locations would be required to support the 1,000-bed general hospital within each theater of operations. In both factors, the complete use of DMS was considered appropriate.

(1) Europe and NEA manhour/bed average. Since both of these are relatively mature theaters, it was determined that buildings of opportunity would be available 60 percent of the time. The necessity for field location of the general hospital, will therefore occur the remaining 40 percent of the time. Figure P-9 provides the breakdown of average manhours/bed for Europe and NEA.

FACTOR VIII: MANHOUR REQUIREMENTS FOR 1,000-BED HOSPITAL CONSTRUCTION (SWA)—FIELD LOCATION WITH USE OF DMS
(Temperate Climate)

	Facility			Manhours						
	Size or	AFCS		Horizontal		Vertical		General		
Item	Unit	Number	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Buildings:										
Latrine	10 x 20 ft	72321 BD	6	2	12	230	1,380	37	222	1,614
Utility #3	30 x 60 ft	51010 MJ	15	31.8	477	2,060.4	30,906	97.2	1,458	32,841
Utility #9	30 x 50 ft	51010 MP	1	55	55	2,877	2,877	137	137	3,069
Hardstand	1,000 SY	85210 BF	18.8	376	7,068.8	0	0	136	2,556.8	9,625.6
Road	mile	85130 FK	1.2	3,849	4,618.8	0	0	1,699	2,038.8	6,657.6
Sump, Fire	10,000 gal	84330 AC	6	18	108	124	744	133	798	1,650
Site Preparation	acre	87190 AA	38.9	101	3,929	0	0	37	1,439	5,368
Sewage	25,000 GPD	83111 AY	1	664	664	1,633	1,633	1,219	1,219	3,516
Total					16,932.6		37,540		9,868.6	64,341.2

Figure P-8

MANHOUR/BED AVERAGES FOR A 1,000-BED GENERAL HOSPITAL (EUROPE/NEA)
(WITH USE OF DMS)

Renovation of buildings of opportunity (Factor II)	8.6 manhours/bed
Percentage of occurrence	x 60 percent
	= 5.16
Field location of General Hospital (Factor IV)	61.4 manhours/bed
Percentage of occurence	x 40 percent
	= 24.56
Average manhours/bed for Europe/NEA	= 29.72 manhours/bed

Figure P-9

(2) SWA manhour/bed average. Since this theater is relatively immature, it was determined that appropriate buildings of opportunity with the necessary utilities will be available only 10 percent of the time. The necessity for field location of the general hospital will therefore occur the remaining 90 percent of the time. Figure P-10 provides the breakdown of average manhours/bed for SWA.

MANHOUR/BED AVERAGES FOR A 1,000 BED GENERAL HOSPITAL (SWA)
(WITH USE OF DMS)

Renovation of buildings of opportunity (Factor VI)	9.9 manhours/bed
Percentage of occurance	x 10 percent
	= .99
Field location of General Hospital (Factor VIII)	64.3 manhours/bed
Percentage of occurance	x 90 percent
	= 57.9
Average manhours/bed for SWA	= 58.9 Manhours/Bed

Figure P-10

b. The planning figures represented in Figures P-9 and P-10 apply only to the TAA-92 force planning structure analyses and will most likely be revised during subsequent TAA planning cycles.

LAST PAGE OF TAB P

TAB Q

TASK 17: DISPENSARIES, DENTAL CLINICS, AND LABORATORIES

TAB Q

TASK 17: DISPENSARIES, DENTAL CLINICS, AND LABORATORIES

Engineer Workload Factors:

	Manhours/Man in COMMZ		
	Europe	NEA	SWA
Total Task:	0.97	0.97	1.73
Skilled Engineer Effort:	0.97	0.97	1.61

1. Standard of Construction:

a. Europe and NEA. Renovation of buildings of opportunity to austere standards for end use as dispensaries, dental clinics, and labs.

b. SWA. Construction of wood-frame buildings to replace tents from which the medical teams operate initially. The Central Dental laboratory, team 8-670H (HE), cannot operate from tents and requires a building from the outset.

2. Method: AFCS facilities for dispensaries and dental clinics are selected on the basis of square foot requirements. These are determined from the area of TOE tentage. AFCS facilities for the dental labs are selected on the basis of population served. For Europe and NEA, where the availability of buildings of opportunity is assumed, facilities for interior only are used to determine manhour construction requirements. For SWA, it is assumed that complete buildings must be constructed and AFCS facilities are selected accordingly. As TM 5-301 does not include the required facilities for Desert Climate, manhour construction requirements for SWA are estimated by multiplying the Temperate Climate requirements by 1.15.

3. Computation:

a. Europe and NEA. Manhour requirements are developed in Figure Q-1. As no separate interior for dental clinic-prosthetic is furnished in TM 5-301, the requirement is estimated as 60 percent of the vertical effort for the complete building.

b. SWA. Manhour requirements are developed in Figure Q-2. Temperate climate requirements are multiplied by 1.15 to adjust for desert climate.

MANHOUR REQUIREMENTS FOR DISPENSARIES, DENTAL CLINICS, AND LABORATORIES--EUROPE AND NEA
(Temperate Climate)

					Manhours											
					Per Facility							Per Man Served				
					Horizontal		Vertical		General							
SRC	Facility	AFCS Number	Number Required	Number of Troops Served	Unit	Net	Unit	Net	Unit	Net	Total	Hori-zontal	Vert-ical	General	Total
8-620H(OB)	Dispensary interior 20' x 70'	55020CH	2	5,000	0	0	910	1,820	0	0	1,820	0	0.36	0	0.36
8-620H(OC)	Dispensary interior 20' x 100'	55020CJ	2	10,000	0	0	2,435	4,870	0	0	4,870	0	0.49	0	0.49
8-670H(HA)	Dental Clinic interior 30' x 130'	54010AN	1	20,000	0	0	2,255	2,255	0	0	2,255	0	0.11	0	0.11
8-670H(HE)	Dental Clinic-prosthetic*	54010AG	1	200,000	105	0	4,118	2,470	497	0	2,470	0	0.01	0	0.01
Total													0.97		0.97

*AFCS Facility No. 54010AG is a complete building; a separate interior is not furnished in the AFCS. The interior requirement is estimated as 60 percent of the vertical requirement of the complete building.

Figure Q-1

MANHOUR REQUIREMENTS FOR DISPENSARIES, DENTAL CLINICS, AND LABORATORIES—SWA
(Desert Climate)

SRC	Facility	AFCS Number	Number Required	Number of Troops Served	Manhours											
					Per Facility							Per Man Served			
					Horizontal		Vertical		General						
					Unit	Net	Unit	Net	Unit	Net	Total	Hori-zontal	Vert-ical	General	Total
8-620H(OB)	Dispensary 20' x 70'	55020CM	2	5,000	35	80.5	1,379	3,171.7	133	305.9	3,558.1	0.02	0.63	0.06	0.71
8-620H(OC)	Dispensary 20' x 100'	55020CN	2	10,000	45	103.5	3,066	7,051.8	186	427.8	7,583.1	0.01	0.71	0.04	0.76
8-670H(HA)	Dental Clinic 30' x 130'	5401AR	1	20,000	73	83.95	3,800	4,370	295	339.25	4,793.2	0.00	0.22	0.02	0.24
8-670H(HE)	Dental clinic-Prosthetic	54010AG	1	200,000	105	120.75	4,118	4,735.7	497	571.55	5,428	0.00	0.02	0.00	0.02
Total											0.03	1.58	0.12	1.73	

*Unit x number required x 1.15. Unit requirement is for Temperate Climate.

Figure Q-2

LAST PAGE OF TAB Q

TAB R

TASK 18: MAINTENANCE FACILITY CONSTRUCTION

TAB R

TASK 18: MAINTENANCE FACILITY CONSTRUCTION

Engineer Workload Factors:

	Manhours/Man in COMMZ		
	Europe	NEA	SWA
Total Task:	1.8	1.8	2.0
Skilled Engineer Effort:	1.4	1.4	1.6

1. Standard of Construction: No construction standard is specified in the AFCS. The buildings are wood-framed shops of modular construction which furnishes a mix of core and maintenance bays. Cladding and roof deck are wood. The floor is concrete.

2. Method: The maintenance shop complex selected as typical consists of two 4,800-square-foot buildings; one with six repair bays and a 1,200-square-foot core, the other with four repair bays and a 2,400-square-foot core. The number of manhours required to construct this complex is divided by 9,600 to arrive at manhours per square foot. As 2.02 square feet of maintenance space are required per man in COMMZ, the manhours per square foot are multiplied by 2.02 to derive manhours per man.*

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*Force Planning Activities.

3. Computation:

a. Europe and NEA. Figure R-1 list the computations for Europe and NEA in a Temperate Climate while Figure R-2 list the computations (in a Temperate Climate) for SWA).

	Horizontal	Vertical	General	Total
AFCS 21410 HL Construction Manhours	406	3,516	1,103	5,025
AFCS 21410 JC Construction Manhours	237	2,484	596	3,317
SUM	643	6,000	1,699	8,342
Manhours/SF (sum/9,600)	0.067	0.625	0.177	0.869
Manhours/man (manhours/SF x 2.02)	0.1	1.3	0.4	1.8

Figure R-1

	Horizontal	Vertical	General	Total
AFCS 21410 HN Construction Manhours	458	3,933	1,233	5,624
AFCS 21410 JE Construction Manhours	273	2,826	685	3,784
SUM	731	6,759	1,918	9,408
Manhours/SF (sum/9,600)	0.076	0.704	0.200	0.980
Manhours/man (manhours/SF x 2.02)	0.2	1.4	0.4	2.0

Figure R-2

LAST PAGE OF TAB R

TAB S

TASK 19: REPLACEMENT CAMP CONSTRUCTION

TAB S

TASK 19: REPLACEMENT CAMP CONSTRUCTION

Engineer Workload Factors:

	Manhours/Replacement/Day		
	Europe	NEA	SWA
Total Task:	11.2	15.1	17.4
Skilled Engineer Effort:	6.9	9.7	11.1

1. Standard of Construction: This installation is the most austere available within the AFCS system. The classification is initial standard. Accommodations are in tents without frames and with earth floors. Tents are erected by users without engineer assistance.

2. Method:

a. The basis of this replacement camp is the AFCS Installation NT 1241, a 375-man troop camp.[1] This size is the most efficient of the AFCS designs with respect to construction manhours.

b. On the assumption that replacements are to be as individuals, or if as units they will not be accompanied by their vehicles, motor pool and maintenance areas are not included.

c. Manhours per replacement are determined by dividing total manhours required to provide the camp by 375. Assuming that replacements arrive daily at a constant rate and that each remains in camp 2 days, the number of spaces required is double the number of daily replacements.

3. Computation:

a. Site preparation. The area without parking and maintenance is 640 x 510 ÷ 43,560 feet = 7.5 acres.

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[1] FM 5-302, Change 4, Drawing NT 1211 - NT 1221.

b. Hardstand. Eliminating the vehicle parking and maintenance area reduces the hardstand requirement by 3.2 thousand square yards from 3.5 to 0.3.

c. Manhour requirements. Manhours to construct the camp are developed in Figures S-1 for Europe, S-2 for NEA, and S-3 for SWA.

d. Manhours per replacement. Manhours per replacement are developed in Figure S-4.

MANHOUR REQUIREMENTS FOR 375-MAN REPLACEMENT CAMP--EUROPE
(Temperate Climate, Rolling Woodland With Moderate Rock)

Item	Facility			Manhours						
	Size or Unit	AFCS Number*	Quantity	Horizontal		Vertical		General		
				Unit	Net	Unit	Net	Unit	Net	Total
Cesspool	acre	83190AA	3	11	33	100	300	156	468	801
Site Preparation	mile	87190AA	7.5	88	660	0	0	32	240	900
Road	mile	85130FD	0.09	2,265	204	0	0	905	81	285
Road Surface	1,000 SY	85110BM	0.09	189	17	0	0	64	6	23
Hardstand	1,000 SY	85210AY	0.3	215	65	0	0	77	23	88
Hardstand Surface		85110DF	0.3	24	7	0	0	8	2	9
TOTAL					986		300		820	2,106
Doubled Requirement					1,972		600		1,640	4,212

*Facility data as shown in FM 5-301, run 850117.

Figure S-1

MANHOUR REQUIREMENTS FOR 375-MAN REPLACEMENT CAMP--NEA
(Temperate Climate, Mountainous Grassy Terrain With Moderate Rock)

Facility				Manhours						
				Horizontal		Vertical		General		
Item	Size or Unit	AFCS Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190AA	3	11	33	100	300	156	468	801
Site Preparation	acre	87190AA	7.5	88	660	0	0	32	240	900
Road	mile	85130FW	0.09	6,850	617	0	0	2,719	245	862
Road Surface	mile	85110BM	0.09	189	17	0	0	64	6	23
Hardstand	1,000 SY	85210BR	0.3	594	178	0	0	184	55	233
Hardstand surface	1,000 SY	85110DF	0.3	24	7	0	0	8	2	9
TOTAL					1,512		300		1,016	2,828
Doubled Requirement					3,024		600		2,032	5,656

Figure S-2

MANHOUR REQUIREMENTS FOR 375-MAN REPLACEMENT CAMP--SWA
(Desert Climate, Mountainous Grassy Terrain With Moderate Rock)

	Facility			Manhours						
	Size	AFCS		Horizontal		Vertical		General		
Item	or Unit	Number*	Quantity	Unit	Net	Unit	Net	Unit	Net	Total
Cesspool		83190AA	3	13	39	115	345	179	537	921
Site Preparation	acre	87190AA	7.5	101	758	0	0	37	278	1,036
Road	mile	85130FW	0.09	7,878	709	0	0	3,127	281	990
Road Surface	mile	85110BM	0.09	217	20	0	0	74	7	27
Hardstand	1,000 SY	85210BR	0.3	683	205	0	0	212	64	269
Hardstand Surface	1,000 SY	85110DF	0.3	28	8	0	0	9	3	11
TOTAL					1,739		345		1,170	3,254
Doubled Requirement					3,478		690		2,340	6,508

Figure S-3

MANHOURS PER REPLACEMENT

		Europe		NEA		SWA	
	Replacements	Manhours	Manhours/ Replacement	Manhours	Manhours/ Replacement	Manhours	Manhours/ Replacement
Total Task	375	4,212	11.2	5,656	15.1	6,508	17.4
Skilled Engineer Effort	375	2,572	6.9	3,624	9.7	4,168	11.1

Figure S-4

LAST PAGE OF TAB S

TAB T

TASK 20: MAINTENANCE TO ROADS

TAB T

TASK 20: MAINTENANCE TO ROADS

Engineer Workload Factors:

a. Europe.

Total Task:	3.77 Manhours/Mile/Day
Skilled Engineer Effort:	1.74 Manhours/Mile/Day
Unskilled Effort:	2.03 Manhours/Mile/Day

b. SWA.

Total Task:	3.96 Manhours/Mile/Day
Skilled Engineer Effort:	1.78 Manhours/Mile/Day
Unskilled Effort:	2.18 Manhours/Mile/Day

c. NEA.

Total Task:	3.77 Manhours/Mile/Day
Skilled Engineer Effort:	1.74 Manhours/Mile/Day
Unskilled Effort:	2.03 Manhours/Mile/Day

1. Standard of Construction: This standard is the most austere level which can perform the maintenance function adequately to support the required traffic flow on the COMMZ road network.

2. Method: Manhour requirements are develope by use of a combination of facilities from the AFCS. Provision is made for snow removal. The snow removal factor is applied as one-twelfth of its effort requirements to each month and includes tasks such as snow fence erection, snow removal, and sanding. AFCS Facility No. 85140 AD provides effort requirements for snow removal, fencing, plowing, and sand spreading for 100 miles of road (double lane) for one season. The maintenance factor also includes a one-half facility for maintenance of an earth surface road (Facility No. 85140 AE) and a one-half facility for maintenance of a black-top road (Facility No. 85140 AC).

3. Computation: Figure T-1 shows the manhour requirements as developed for routine road maintenance.

ROAD MAINTENANCE (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Based on 100 miles for 30 days:				
1/12 Facility No. 85140 AD (snow)	297	317	700	1,314
1/2 Facility No. 85140 AE (earth surface)	1,800	--	2,400	4,200
1/2 Facility No. 85140 AC (bituminous surface)	2,125	685	2,980	5,790
Total	4,222	1,002	6,080	11,304
Based on 1 mile for 1 day	1.41	0.33	2.03	3.77

Figure T-1

4. Method Modifications for SWA: The following modifications have been made to adjust the methods of estimating to conform to conditions in SWA.

a. The snow removal facility has been retained but is applied only in the mountainous areas. No modification of this facility is made for desert conditions of heat and dust since those conditions are not expected to exist when and where snow removal is required.

b. The same ratio (half and half) of earth surface to bituminous surface maintenance is kept for this area. Desert Zone factors are used which increase the labor factors by about 15 percent.

6. Computation: Figure T-2 shows manhour requirements for routine road maintenance.

ROAD MAINTENANCE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Based on 100 miles for 30 days:				
1/12 Facility No. 85140 AD (snow)	297	317	700	1,314
1/2 Facility No. 85140 AE (earth surface)	2,070	--	2,760	4,830
1/2 Facility No. 85140 AC (bituminous surface)	2,259	400	3,077	5,736
TOTAL	4,626	717	6,537	11,880
Based on 1 mile for 1 day	1.54	0.24	2.18	3.96

Figure T-2

6. Method Modifications for NEA: No method modifications are needed to adapt European road maintenance factors to NEA.

7. Computation: Figure T-3 shows manhour requirements for routine road maintenance in NEA.

ROAD MAINTENANCE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Based on 100 miles for 30 days:				
1/12 Facility No. 85140 AD (snow)	297	317	700	1,314
1/2 Facility No. 85140 AE (earth surface)	1,800	--	2,400	4,200
1/2 Facility No. 85140 AC (bituminous surface)	2,125	685	2,980	5,790
Total	4,222	1,002	6,080	11,304
Based on 1 mile for 1 day	1.41	0.33	2.03	3.77

Figure T-3

LAST PAGE OF TAB T

TAB U

TASK 21: MAINTENANCE TO RAILROADS

TAB U

TASK 21: MAINTENANCE TO RAILROADS

Engineer Workload Factors:

a. Europe.

Total Task:	6.57	Manhours/Mile/Day
Skilled Engineer Effort:	1.82	Manhours/Mile/Day
Unskilled Effort:	4.75	Manhours/Mile/Day

b. SWA.

Total Task:	9.2	Manhours/Mile/Day
Skilled Engineer Effort:	2.7	Manhours/Mile/Day
Unskilled Effort:	6.7	Manhours/Mile/Day

c. NEA.

Total Task:	7.9	Manhours/Mile/Day
Skilled Engineer Effort:	2.2	Manhours/Mile/Day
Unskilled Effort:	5.7	Manhours/Mile/Day

1. Standard of Construction: The standard of maintenance applied is the most austere level which will keep the rail net operating at the required capacity.

2. Doctrinal Implications: As stated in Task No. 3, current doctrinal publications indicate that the mission of maintenance and repair to railroads is a transportation-unit responsibility. The Transportation Railway Engineer Company, TOE 55-227, in fact, has a TOE mission statement--"to maintain and repair railway tracks, bridges, buildings, and railway signals and communications within a railway division." Though none of these units are currently within the Army Force structure, one company is scheduled for activation in FY 87. Should this unit be deployed to a specific theater of operations, the workload generated by this task would not be accomplished by engineer units.

3. Method. Maintenance requirement is estimated as one-tenth of 1 percent of repair/restoration applied on a daily basis (Tab C, Task 3).

4. Computation: Figure U-1 shows the derivation of the manhour requirements for this task.

RAILROAD MAINTENANCE (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Facility No. 86010 AA (1 Mile, Single-Track)	1,818	--	4,752	6,570
Maintenance/Mile/Day	1.82	--	4.75	6.57

Figure U-1

5. Method Modification For SWA: In this area, maintenance is estimated as in Europe as one-tenth of 1 percent of repair/restoration, and is applied likewise on a daily basis. Adjustments were made for desert and mountainous environments. See the SWA modifications in Task 3 (Tab C of this report) for a detailed explanation.

6. Computation: Figure U-2 shows the derivation of manhour requirements for this task.

RAILROAD MAINTENANCE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Damage Repair--1 Mile Single Track*	2,548	--	6,669	9,211
Maintenance/Mile/Day	2.5	--	6.7	9.2

*From Figure C-4 (Tab C).

Figure U-2

7. Method Modification For NEA: As in the other areas of this report, maintenance is estimated as one-tenth of 1 percent of damage repair and is applied on a daily basis. Adjustment to the European factor was made to account for the mountainous terrain.

8. <u>Computation</u>: Figure U-3 shows the derivation of manhour requirements for this task.

RAILROAD MAINTENANCE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Damage Repair--1 Mile Single Track*	2,192	--	5,732	7,924
Maintenance/Mile/Day	2.2	--	5.7	7.9

*From Figure C-5 (Tab C).

Figure U-3

LAST PAGE OF TAB U

TAB V

TASK 22: MAINTENANCE TO PIPELINES

TAB V

TASK 22: MAINTENANCE TO PIPELINES

This task is expected to be accomplished by non-engineer pipeline specialists. Thus, it is not expected to generate a calculable engineer workload for purposes of the FASTALS Construction Model at this time. Should this situation change in the future, the task will be addressed in this tab.

LAST PAGE OF TAB V

TAB W

TASK 23: MAINTENANCE TO PORTS

TAB W

TASK 23: MAINTENANCE TO PORTS

Engineer Workload Factors:

a. Europe.

Total Task:	0.011 Manhours/Ton/Day
Skilled Engineer Effort:	0.009 Manhours/Ton/Day
Unskilled Effort:	0.002 Manhours/Ton/Day

b. SWA.

Total Task:	0.017 Manhours/Ton/Day
Skilled Engineer Effort:	0.013 Manhours/Ton/Day
Unskilled Effort:	0.004 Manhours/Ton/Day

c. NEA.

Total Task:	0.012 Manhours/Ton/Day
Skilled Engineer Effort:	0.009 Manhours/Ton/Day
Unskilled Effort:	0.003 Manhours/Ton/Day

1. Standard of Construction: The standard of maintenance applied to ports is the most austere level which will permit sustained operations at the required capacity.

2. Method. Port/wharf maintenance is estimated to be one-tenth of 1 percent of the repair effort applied on a daily basis. Port repair is described in Task 6 (Tab F).

3. Computation: Figure W-1 shows the manhour requirements for port maintenance.

PORT MAINTENANCE (Europe)

	Manhours			
	Horizontal	Vertical	General	Total
Damage Repair (per ton/capacity)	1.8	6.6	2.5	10.9
Maintenance (per ton/day/day)	0.002	0.007	0.002	0.011

Figure W-1

4. <u>Method Modification For SWA</u>: In this area, maintenance is estimated as one tenth of 1 percent (as in Europe) of the repair requirement and is applied on a daily basis. The same factors which, in this geographic area, increase repair effort also increase maintenance.

5. <u>Computation</u>: Figure W-2 shows the manhour requirement for port maintenance.

PORT MAINTENANCE (SWA)

	Manhours			
	Horizontal	Vertical	General	Total
Damage Repair (per ton/capacity)	2.8	10.0	3.8	16.6
Maintenance (per ton/day/day)	0.003	0.01	0.004	0.017

Figure W-2

6. <u>Method Modification For NEA</u>: As in other areas, maintenance is estimated as one tenth of 1 percent of repair and is applied on a daily basis. The same assumptions made to modify the repair factor are assumed to affect maintenance in the NEA area.

7. <u>Computation</u>: Figure W-3 shows the manhour requirements for port maintenance.

PORT MAINTENANCE (NEA)

	Manhours			
	Horizontal	Vertical	General	Total
Damage Repair (per ton/capacity)	2.1	7.3	2.8	12.2
Maintenance (per ton/day/day)	0.002	0.007	0.003	0.012

Figure W-3

LAST PAGE OF TAB W

TAB X

STUDY REVIEW COMMENTS

TAB X

STUDY REVIEW COMMENTS

1. Purpose. At the completion of this study, ESC published a draft report that was distributed for review and comment by the study sponsor and a select list of agencies interested in the study topic. The purpose of this tab is to present the results of that review process.

2. Scope. This tab presents only the significant and substantive comments ESC received on the draft report. (No editorial comments are included since they were automatically included in the final report, either in response to the review comments or as part of the ESC's routine editorial process.) Following each comment is a description of the action ESC took as a result of the comment.

3. Disposition of Comments.

a. Comment. The workload factors for Hospitals (Tab P, Task 16) should be expanded to provide a full range of factors that can be combined to represent all possible combinations of conditions. New factors for SWA should be provided for the use of DMS with and without the renovation of facilities, and a workload factor for all theaters should be developed to reflect the absolute minimum engineer work required to place a hospital with DMS in a field location. The latter factor should be developed in coordination with the Army Surgeon General's Office. RESPONSE: Concur; factors were developed and incorporated into Tab P. Coordination with the Directorate of Health Care Operations (Mr. W. J. Balderson) was instrumental in reviewing, line by line, the minimum engineer requirements for a general hospital in a field location.

b. Comment. The tasks of Damage Repair to Railroads (Tab C, Task 3) and Maintenance to Railroads (Tab U, Task 21) can be accomplished by the Transportation Railway Engineer Company (TOE 55-227) if that unit(s) were deployed to the contingency area on the Army force list. RESPONSE: Should that unit be activated in the Active or Reserve component and be deployed to the theater of operations, the workload generated by the two railroad tasks would contribute to transportation workload rather than engineer workloads. Appropriate comments have been incorporated in Tabs C and U.

LAST PAGE OF TAB X

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